Man Among the Planets

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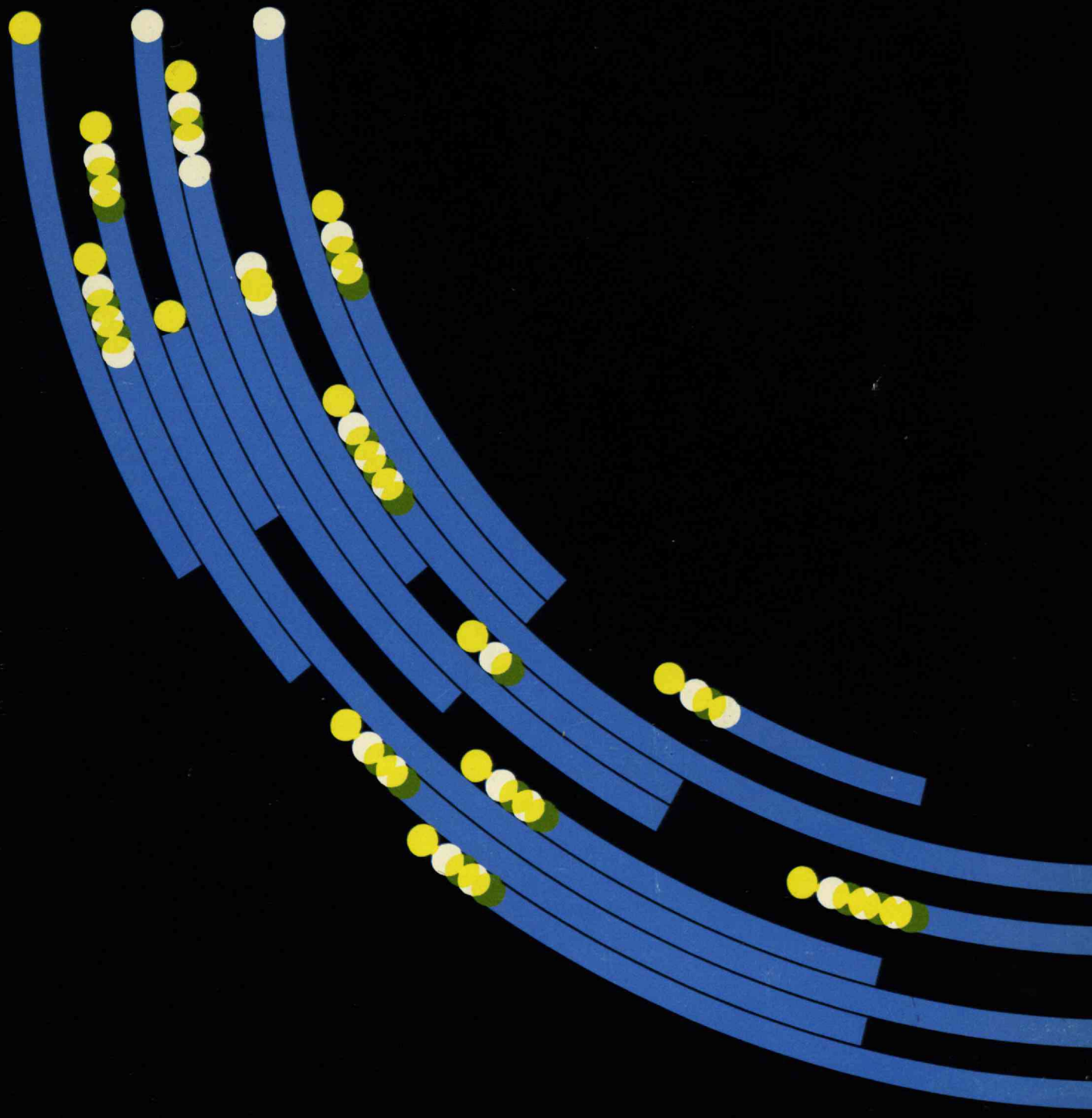
A special issue on man's increasing knowledge of his larger environment: Don L. Anderson, Thomas Gold, John S. Lewis, Gordon J. F. MacDonald, Ursula Marvin, and Victor K. McElheny

+ Technology Review



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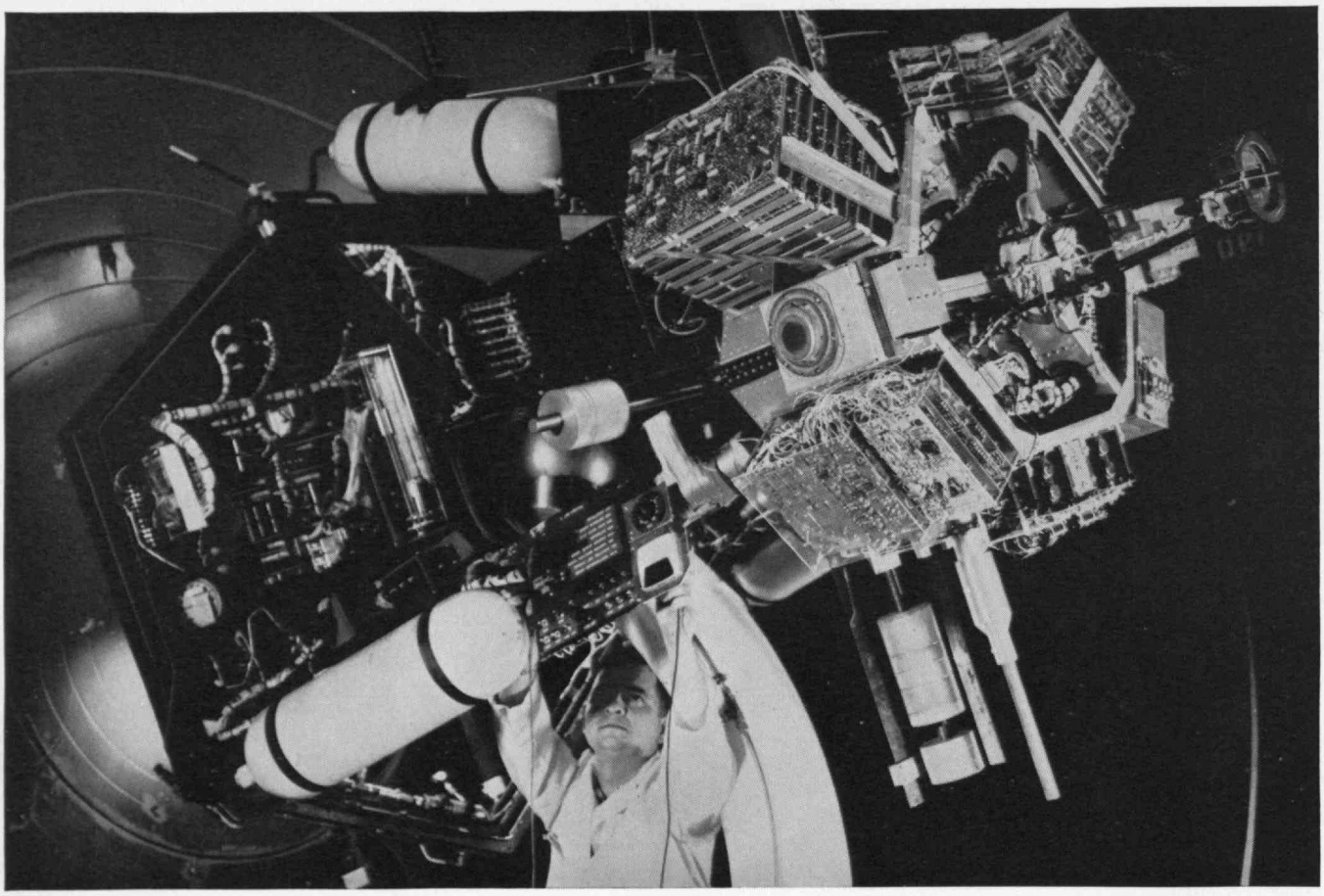

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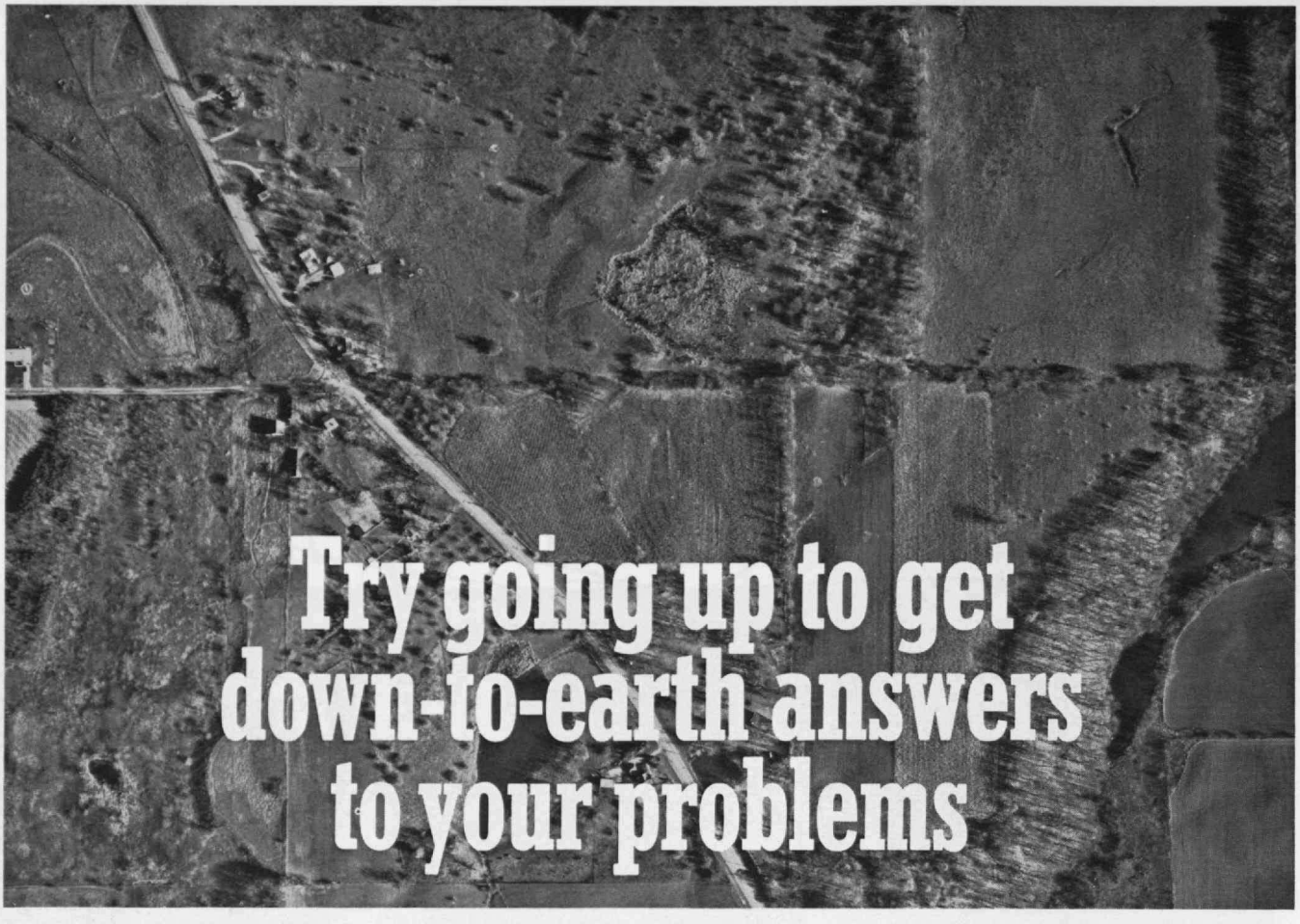

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The First Line

One of this Editor's special opportunities —as well as one of his frustrating preconditions—is that *Technology Review* has responsibilities to its institutional readers—alumni of the Massachusetts Institute of Technology—as well as to its general readers, those who subscribe to the *Review* out of their concern with the progress and consequences of modern technology. If to the latter our content seems occasionally to focus too narrowly on institutional concerns, let them recall that the concerns of higher education today are more national concerns than ever before, and that this is largely true because our culture has so fully embraced the products of intellectual—and especially scientific—endeavor.

As this issue of *Technology Review* reveals—and as future issues will confirm —there is little comfort for institutions of higher education as the year opens this fall. The gulf which separates them from some of the young people who should be their principal beneficiaries is at least as wide as it was last spring, because its basic causes are unresolved; costs have continued to rise at rates far above the nation's average of inflation; public support, especially in the sciences, continues to falter; in its effort to spread more equitably the burden of taxes, the Congress has proposed changes in the income tax laws which threaten severely to limit the support of those who have been private higher education's principal recent benefactors.

But to one observer of the scene in Cambridge, there is a new and remarkable change to set against these darkening prospects. As this is written, more than 500 alumni of M.I.T. have just completed intensive exposures—intentional and to some extent unexpected—to the contemporary college scene. Far from closing their minds to the issues with which today's students have brought fear and embarrassment to many campuses, most of these alumni embraced enthusiastically their opportunities to understand the sources of today's frustrations. If alumni interest ever was in fact confined to collegiate football and beauty queens, the times seem significantly changed: is not today's alumnus in fact an ardent intellectual partner of the university and its students in their quest for a more rational world?

Volume 72
Technology Review opens its 72nd volume with two new names. Victor Cohn, who won distinction as a reporter of scientific affairs for the Minneapolis-St. Paul papers before becoming Science Editor of the prestigious *Washington Post* three years ago, will write regularly from the nation's capital. Few know Mr. Cohn's contribution to the *Review* as a member of our Editorial Advisory Board, but all will fortunately sense his contribution through "Washington Report."

The Review is also pleased to announce the appointment of Janet Kreiling as Associate Editor. Trained in science and writing at the University of Wisconsin, Miss Kreiling has been associated with the University of Wisconsin Medical Center and more recently with the University of California (Berkeley) Institute of Transportation and Traffic Engineering.

This Month
For three of the six articles in this "special," *Technology Review* is indebted to the American Association for the Advancement of Science. The papers by Gordon J. F. MacDonald, Thomas Gold, and Don L. Anderson were originally given at a symposium arranged by Frank Press, Head of the M.I.T. Department of Earth and Planetary Sciences, for the 1968 A.A.A.S. meeting; they are published in the *Review* through the cooperation of the authors and of Walter Berle, A.A.A.S. annual meetings editor.

This month's cover, an abstraction of planetary orbits, is by Dietmar Winkler of the M.I.T. Office of Publications

Next Month
For December, *Technology Review* announces articles on major fields of current engineering interest: the status of nuclear-powered aircraft design, the new technology of welding and its implications for production processes. We'll also include an account of the applications of computers in collective bargaining and a report on studies of the attitudes of scientists working in a major international laboratory.—J.M.

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for
October/November, 1969

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How the Harwell Atomic Research Establishment "has taken up a challenge that Americans largely have been dodging."

Reorientation and "Maximum Unfairness"

It's a joy to visit a friend who's pulled himself out of a slump. Coming back to Britain's Harwell Atomic Research Establishment is a bit like that, having last seen it two years ago.

At that time, gloom hung thickly about the great laboratory. For two decades, it had spearheaded Britain's development of atomic power. But, the pioneering was over. The research now required wouldn't fully engage Harwell's formidable talents. There was talk of cutbacks. Staff was drifting away. Uncertainty clouded the future.

What a difference now! The place radiates enthusiasm. For Harwell has done what many American national laboratories have merely speculated about. It has successfully re-focused itself to take on a new, nationally important mission. It is reaching beyond atomic matters to enter contract research with industry.

Merely to describe the mission that way, however, obscures the basic point. Certainly it won't impress Americans who wonder why Britain hasn't caught on to the virtues of contract research before. To see it with British eyes, though, you have to realize that an elaborate, multidisciplinary, and under-used national laboratory has been put to work on the number one national problem—how to help industry compete more effectively in the world market.

Put that way, Americans should see that Harwell has taken up a challenge that Americans largely have been dodging. There's been a lot of talk about turning the big atomic or space laboratories loose on some of America's urgent national problems. But only Oak Ridge National Laboratory—whose director Alvin Weinberg is a prophet of reorientation—has moved away from its traditional mission, notably into desalting research. Certainly the need to diversify is there as well as the challenge, the same need that drove Harwell. As Dr. Weinberg has often asserted, the big atomic laboratories no longer have enough to do in nuclear fields to justify themselves. As the budget pinches, big space laboratories, too, speculate about new outlets.

There was, for example, a curious similarity between the gloom at Harwell two years ago and the apprehension I sensed during interviews at the Jet Propulsion Laboratory last fall. Tightening space budgets were forcing cutbacks. You heard jokes such as "If I don't see a colleague for a couple of weeks now, I assume he's been dropped." The laboratory was making quiet studies of possibilities for diversifying.

Since then, two successful Mars fly-bys and newly authorized planetary projects have revived J.P.L. spirits. But with the prospect of continued tight budgets, the impulse to find new outlets persists.

Reorienting the Laboratories

Why not use some of the facilities and talents of big government laboratories on national problems outside their primary mission? Why not indeed?

The challenge would be more to the individual scientist than to laboratory management were this to be tried. It takes great flexibility and humility to switch from what these scientists have been doing and tackle a wholly new order of problems. They would have to adapt to such alien modes of thought as those of city politics or the established transport industry. I think a lot of practically-minded people have their doubts about this. And this is where Harwell's experience is relevant. Learning to work with industry was just this kind of adaptation to an alien culture for Harwell staffers.

Laboratory director Dr. Walter Marshall explains: "We started with about 1000 naive scientists. We wondered how to go about establishing an industrially sophisticated program. Should we get in a commercial team to help or should we make the scientists themselves responsible for thinking out commercial implications of their work? The first choice would isolate the scientists. But the alternative was pretty frightening.

"We had to try to educate 1000 naive scientists to have a business sense and a commercial sense. You could anticipate chaos. Yet, we decided not to impose any organization between scientists and industrial firms, but to make the communication as good as possible. This calls for a very big change in the scientists' thinking (especially in a country where scientists traditionally despise this sort of thing)."

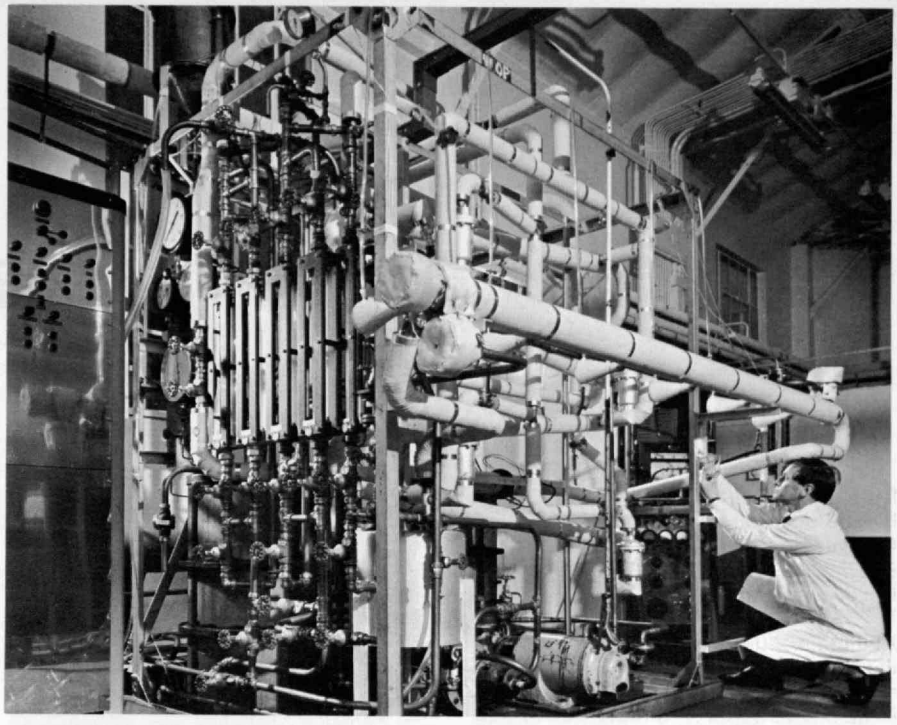
As it turned out, the direct involvement captured the scientists' imagination. It may well underlie the boost in morale so evident here. The sense of involvement runs right through the professional staff; although only about 30 per cent of Harwell's £15 million ($36 million) budget goes for the industrial work, most individual scientists and engineers take part.

"In practice," Dr. Marshall says, "all the scientists work on everything. It's the science that holds everything together. So, typically, a scientist you meet has responsibilities in reactor research, basic research, and the new commercial research. All are grossly overworked now, but all are tremendously excited. It's a new challenge. It's the excitement that holds them up. When a whole site works on all activities, the cross fertilization is extremely large. This keeps the place lively. It's a rebirth."

Harwell offers industry a range of services from straight consulting for a fee to sharing the costs, and the profits, in developing new products and processes. These latter may spring from Harwell inventions. In such cases, Harwell commissions its own market survey before approaching possible industrial partners. For example, a nuclear fuel element fabrication process is being adapted (with commercial partners) for making bricks. It could replace the usual pressing operation with a continuous process, giving novel shapes and cutting costs.

This kind of development puts a premium on scientists' ability to spot commercial possibilities in their work. Dr. F. J. P. Clarke, who heads Harwell's Ceramics Center, which does a lot of the risk-sharing development, finds scientists as imaginative in ferreting out commercial potential as in solving the problems of "pure" research.

"All of our work is market oriented and we find the scientists like it," he says. "We've far more ideas in this building than staff to follow them up."



A two-component condensation rig—one of the many experimental engineering systems used by Harwell's Heat Transfer and Fluid Flow Service. The U. K. Atomic Energy Authority's expertise in this field is applied to industrial problems under a confidential consultancy and testing scheme. (Photo: U.K. Atomic Energy Authority)

In spite of the tradition that British scientists tend to despise "market oriented" research, Dr. Clarke feels it has only stimulated the staff's capacity for original thought. He notes that "originality depends on a person. And if he's interested, his originality develops in a new environment. Applied research is more difficult than basic research because the scientist must live in the real world. It's much harder to transform the real world than an idealized world."

"From our experience here, we can say definitely that shifting to commercial work doesn't kill off originality." So much for one of the traditional bugaboos of the British scientist.

Much of Harwell's commercial work is done under "the principle of maximum unfairness," one of Dr. Marshall's more widely quoted aphorisms. That means working on a specific development with one or two specific firms, in tight commercial secrecy, and excluding the firm's competitors. Harwell gets away with it, Dr. Marshall says, because excluded competitors recognize this as the best way to beef up industry. They know they can arrange their own secret deals when this is to their advantage.

Because of the secrecy, Harwell can't boast much of its commercial results. The greatest success that so far is talked about is the saving of the Weir-Westgarth Company, makers of desalting equipment. While it once served the bulk of the world market, the company was losing out to American competition. Desalting is a technology that advances by chipping away at the engineering problems, boosting efficiency and lowering costs. Weir-Westgarth hadn't been able to keep up.

Reluctant to let a big exporter die, the government asked the Atomic Energy Authority to step in. The 1965 Science and Technology Act had provided for such aid by authorizing the A.E.A. to work outside the atomic field. The Authority poured in money and research, especially Harwell's help. Over the past year, the company has made a comeback, filling its order books once again.

While there will be royalties from the Weir-Westgarth work, the payoff comes more in what Dr. Marshall calls "national benefit." "They're back in the export business, earning foreign exchange and paying taxes," he says. "They will pay a levy on their sales to compensate the government. But that money will come in over the next 15 years. So while the nation benefits, the cash return hasn't yet shown up in Harwell's budget."

While Dr. Marshall regards such national benefits as the most important return on his laboratory's work, he does have an eye for direct income. Admitting it's hard to put a present value on future royalties, he guesses the lab already has some £4 million to its credit. Over the long term, he expects the royalties more or less to cover related costs. "If you look at us as a long-term business, we are a risky business; but we're not running at a loss," he figures.

He admits, though, that he can't look forward to balanced budgets. He explains that "two years ago, we had zero cash income. In the present fiscal year, we already know it will exceed £500 thousand. And it's going up at a rapid rate. But we don't expect immediate cash income at any time to match immediate outlay. A commercial firm couldn't operate like this. But it's all right for a government laboratory trying to benefit the nation."

Reorientation for American Laboratories?

Dr. Marshall makes only modest claims for Harwell's commercial success so far. "We've made a promising beginning," is the most he'll say. And at this stage, it's hard to judge how well that promise will be fulfilled. Certainly, if other government laboratories follow Harwell's example, British industry would get strong new technological muscle. So far, though, other groups have shown tepid enthusiasm for the idea in spite of government prodding. They lack the spur of needing a new mission.

But, that's an internal British problem. The feasibility of radically refocusing a laboratory like Harwell has been established. It's a lesson from which a number of countries undoubtedly can profit.

No one would suggest, of course, the American labs might do what Harwell is doing. There's no need for such aid to industry. And what American government laboratory could operate under a "principle of maximum unfairness" anyway?

Dr. Marshall notes that each laboratory in other countries should work out for itself what are the most fruitful new directions in which to grow. Speaking of America, he says he "can see that a number of United States Government laboratories need to reorient. I believe because of their high caliber this can be done, and should be done, and can be done successfully by analogy to Harwell."

Robert C. Cowen, Science Editor of the Christian Science Monitor, *is a Past President of the National Association of Science Writers; he is writing from the* Monitor's *London office in 1969-70.*

London Report
Alan G. Mencher

Despite its manifold problems, "Britain remains scientifically and technologically alert, a formidable industrial competitor. . . ."

Making Technology Pay: A British Dilemma

Consonant with her strong scientific tradition, Britain continues to be an outstanding world leader in basic research. Since World War II, more scientists from Britain than from any other country (relative to their respective populations) have won Nobel Prizes.

The British are also a highly inventive people, numbering among their discoveries and inventions or early developments: penicillin; the jet engine; radar; the hovercraft; the swing-wing principle; carbon fiber reinforced materials; and the fuel cell. In addition, the systems approach evolved from operations research, which began in Britain during World War II.

A major problem facing the British, however, is under-exploitation of discoveries and inventions, including their own. Though British nuclear reactor technology is impeccable, and the nation has the largest installed nuclear power plant capacity in the world (7 per cent of its electric power capacity), no reactor has been sold abroad since 1959. Many superbly engineered British aircraft are price-wise poorly competitive in world markets. Although the consolidation of the British computer industry has made International Computers Limited the largest computer company outside the U.S., it is struggling to wrest leadership of the domestic market from IBM-UK.

Needed: Sophisticated Innovation

Thus, Britain's biggest technological dilemma is not technological. It is the insufficient development of the innovative process, that long and tortuous path leading an idea, an invention or a discovery from conception to the market place. This process is intimately affected by tax policy; by management skills and attitudes; by social structure and attitudes; and by the relations of labor with government and with industry. All of these interacting topics are currently the subject of intense debate in Britain. The complexity of their impact upon the innovative process is indicated by the fact that Britain has confounded those searching for a positive correlation between technology and economic growth.

Despite the demonstrated talent of British scientists and engineers, and a total national research and development expenditure of about $2.4 billion (close to 3 per cent of the G.N.P., and in that respect behind only the U.S. and the U.S.S.R.), Britain's economic growth has been among the slowest in Western Europe. The role of innovation in this anomaly has been of particular concern to Sir Solly Zuckerman, Chief Scientific Adviser to the Government, and to Lord Blackett, President of the Royal Society and Scientific Adviser to the Minister of Technology.

Britain imports some 50 per cent of its food and raw materials. To maintain some sort of equilibrium in its balance of payments, the government must strongly encourage industry to concentrate on exports. Although Scotch whiskey and automobiles are more important sources of foreign currency, considerable reliance is also placed on the manufacture for export of sophisticated technological products. Discovery that the cost-to-weight ratio (an index of sophistication) of imported products is higher than that of exported products was therefore disconcerting. Also awkward were the results of studies comparing profit per employee in the British, German and U.S. electrical industries as well as in the British, Swedish, Dutch, Japanese, German and U.S. electronic industries. These show Britain badly lagging (in the case of electronics by an astounding factor of five, with respect to a leading U.S. company) and reflect the fact that the productivity of the British worker is on the average some two and one-half times less than that of his American counterpart.

The extent of this disparity is surprising (except to those economists who understand its causes), since fewer man-hours per employee are lost annually in Britain than in the U.S. due to labor disputes.

Toward Economic Return from Science

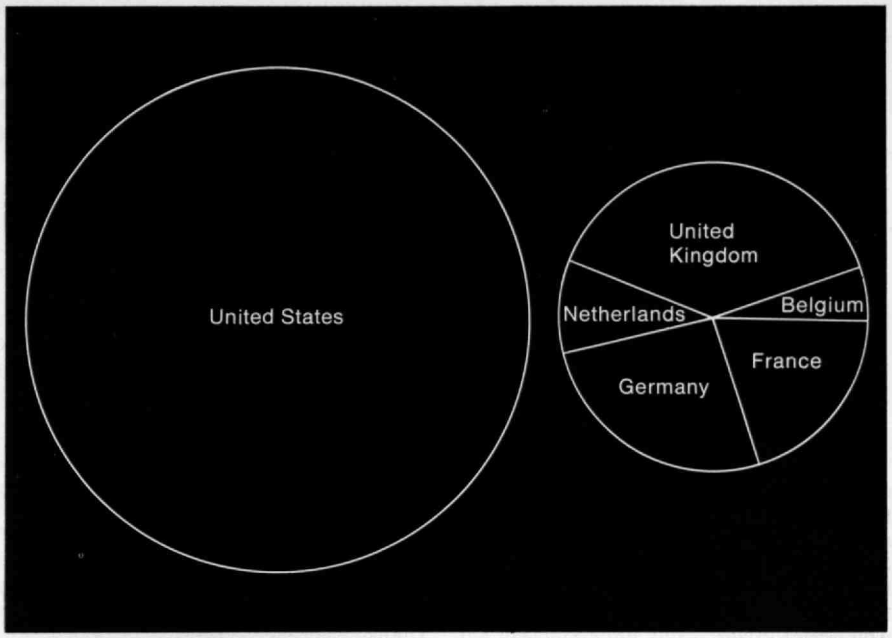
Because of slower economic growth and heavy financial commitment to science and technology, Britain has come to terms, before most other advanced industrial nations, with a slow-down in the rate of increase of research and development expenditures and with the need to allocate these funds in the light of economic return. By 1966, the British scientific community had generally accommodated to the fact that an economy growing at the rate of about 2 per cent could not indefinitely support a 13 per cent annual expansion of its scientific research effort. As a result, the rate of growth in that sector has come down to 9 per cent and may well continue to decline despite the hopes and efforts of the scientific community.

To respond to the newly acknowledged role of technology in national affairs and the need for an economic return from government funding of science and technology, the Labor Party created a Ministry of Technology in 1964 to be the guiding spirit of the engineering industries. In 1968, the Minister of Technology announced a policy of cost-effectiveness as the criterion for investment in technological programs, both national and international. (This also provided an incidental but convenient rationale for opting out of ELDO and of the CERN 300-GeV. accelerator.) The cost-effectiveness criterion has even become important for postgraduate research grants awarded by the Science Research Council, which favors applications-oriented proposals.

In addition, government laboratories, especially the Atomic Energy Authority facilities at Harwell, are increasingly involved in contract research for industry, and a Programs Analysis Unit with a high-powered staff of systems analysts reviews for cost-effectiveness the programs of the Ministry of Technology's numerous laboratories, which contain perhaps too large a share of the nation's best scientific talent outside the universities.

MinTech Working for Industry

The Ministry has undertaken a variety of innovative programs to increase the efficiency of British industry, particularly the smaller units. However, so far there have been no measurable effects on the overall growth of the economy. Success has been limited partly because in experimenting with a large variety of devices to harness the nation's technical talent for the national benefit, the Ministry has been unable to concentrate in depth on any one program. One of its major accomplishments thus far has undoubtedly been a greater public awareness of the inadequacies of the traditional methods of management, produc-



One measure of a nation's power for innovation in technology is the number of its scientists and engineers engaged in research and development. O.E.C.D. figures indicate that in 1962 three times as many scientists and engineers were at work on research and development in the U.S. as in Western Europe; the ratio dropped to 2:1, said O.E.C.D., if technicians and other supporting staff were included. (Data: O.E.C.D. discussion paper, "Resources in Research and Development," December 15, 1965)

tion and marketing to which much of the nation's industry still clings. Perhaps just because of these inadequacies, industry initially entertained a mistrust of MinTech on the grounds that it lacked sufficient staff with industrial experience and an understanding of industrial problems and the industrial point of view. This reaction is gradually being overcome.

By far the most successful of the government-financed efforts to spur innovation in industry is the National Research Development Corporation, a quasi-independent body operating as a private institution with $240 million of Exchequer funds available to help good ideas, inventions and discoveries evolve into viable products. Although it is difficult to assess the overall N.R.D.C. box score, the Corporation has had some unusual successes, including handsome returns on a British-discovered antibiotic produced under license in the U.S.

On the international scene, Britain has in the last three years launched verbal initiatives on technological cooperation with Europe which it never followed up with specific proposals. The reasons for this include an understandable reluctance to make available to foreign nationals expertise on technical areas which could constitute bargaining cards in any negotiation to "enter Europe." In addition, technological links with Europe were hardly promoted by fragmentation of responsibility among a host of British government departments, for various scientific and technological sectors, particularly space, which are especially susceptible to international cooperation.

Technology Gap and Brain Drain

The most controversial technological issues confronting the U.S. with Britain in the past few years have involved the brain drain and the ascendency of American industry in Western Europe. These led to the identification of a "technology gap" (also referred to as a management or innovation gap) and the christening by Servan-Schreiber of an "American challenge." Their implications for Britain were explored in two government reports entitled "The Brain Drain" and "Technological Innovation in Britain." These documents are characteristic of the British propensity for self-examination. They clearly identify and cogently analyze the central points and focus on the need for an environment more favorable to retention by Britain of its scientists and especially its engineers; and to the cultivation of innovative skills. The matter may not be closed nor the challenge removed, but in Britain, the level of publicly expressed concern is unlikely to regain its former pitch.

Much of the discussion on the American challenge involved the spread of university education well beyond the elite groups to which it has been traditionally confined in much of Europe. In this connection it should be noted that the number of British universities has more than doubled since World War II. Management schools, still in a relatively early stage of development, are growing in size and number and are probably more integrated into the existing educational system than is the case in any country on the Continent.

The admirable stability characterizing so many British institutions is seen in its university system. Excepting the London School of Economics and Essex University, dislocations due to student unrest have been modest. Some of the complaints receiving press attention centered on fees for the use of university car parks and on the spout height of coffee vending machines (causing miniskirted coeds the indignity of exposure on bending). Much credit for the vision and flexibility making this success possible must go to university and higher education authorities, especially those concerned with the new universities.

In other cases, stability and tradition restrain desirable currents of change. For example, British problems in harnessing technology are recognized and understood in Britain. But solutions are complicated by the structure of government institutions, so well adapted to Victorian times, and the environment, with its strong residue of social barriers and its more relaxed attitudes towards work and leisure.

In spite of all, Britain remains scientifically and technologically alert, a formidable industrial competitor and a strong potential partner of the Continent. In trying to understand the seeming contradictions, one is tempted by the reasoning of an economist explaining the absence of a British balance of payments problem in the eighteenth century—"there were no statistics."

Alan G. Mencher, who studied at M.I.T., Yale, and the University of California (Los Angeles), is Scientific Attache at the American Embassy in London. He has been with the U.S. Foreign Service since 1957, having previously held engineering assignments in the aeronautics industry.

"Project Apollo is not a science program and never has been. . . . And rather than bother with painstaking scientific exploration of the moon, many men of N.A.S.A. would far rather move quickly to bigger and better manned missions—to a great space station first, then Mars."

"Nary a Scientist Aboard"

The inquiring scientist—to the lovers and leaders of America's space program—is a kind of anointed hitchhiker. You can't fly without him, but you keep him in the back seat.

This became abrasively apparent last summer when, at the height of the success of Apollo 11, a set of key scientists' resignations were received by the National Aeronautics and Space Administration. At the same time, the very lunar scientists who were so thrilled to get lunar samples were complaining sadly that "N.A.S.A.'s glad enough to say a mission is 'for science.' But as far as really doing science—'Sure,' they say, 'if it doesn't cost too much, if it doesn't take too much time, if, if, if.' In other words, for the flight planners and engineers, getting there and back is the big job. They don't see science playing more than a secondary role, which can be dropped when it gets in the way of a mission."

The main troubles, the scientists say, are that:

◇ N.A.S.A.'s main program, Project Apollo, is not a science program and never has been. It has been a program to put man in space and put Americans on the moon. It has done these things and done them magnificently. But the amount of science done in the process—in the estimation of lunar geologist Eugene Shoemaker of Caltech—has been "minuscule." Apollo furthermore badly distorted some potentially important scientific programs—Surveyor, Ranger, Orbiter—to make them almost purely Apollo test and mapping operations. Any science obtained was a by-product. To save funds for manned landing, all these programs were cut off as soon as the mapping of a narrow strip of the moon was completed. No more unmanned lunar programs were planned, though the schedule of manned lunar landings will by no means do all the studies which lunar scientists would like. Almost needless to add, N.A.S.A.'s other unmanned space studies—by space satellites and probes—have also taken a back seat to manned flight, in dollars and attention.

◇ The voice of science in N.A.S.A., especially in manned flight—this lordly lion in the N.A.S.A. menagerie—has generally been weak and unheard. Homer Newell, a physicist, is an Associate Administrator of N.A.S.A. He is a good man, but he has not been counted a mover and shaker in Project Apollo. That role in the past few years has been played mainly by Wilmot Hess, Director of "Science and Applications" (note that science alone is not quite important enough for its own directorate) at Houston's Manned Spacecraft Center. Bill Hess was brought to M.S.C. to try to inject more scientific experimentation, as contrasted with engineering development, into manned flight, and to attract some good scientists. He made a good start.

But in late summer—disheartened over "losing too many battles"—he was offered, and accordingly accepted, a job heading the Environmental Science Service Administration's research labs. At the same time, Donald Wise, bright young chief scientist in the Office of Lunar Exploration at N.A.S.A. headquarters in Washington, decided to return to academic life. Wise too had concluded that science and "Houston"—meaning the manned flight operational chiefs—were on separate beams. Even the Office of Lunar Exploration, Wise feels, "has never really developed a strong lunar science competence."

Last April—at a meeting in Houston of the 142 "PI's", or principal investigators, who would study the moon and its rocks—Hess disclosed that 60 PI's had signed a petition asking that future lunar landings be slowed to something like two a year, to permit more time to plan the science. "Do you think the petition is going to have much influence at N.A.S.A. headquarters?" Hess was asked. He answered, "Probably not."

Low Men on the Totem Pole

Even since Apollo 11—among other things, certainly a very expensive geological field expedition—there have been pointed symbols of scientists' lowly position in the N.A.S.A. pecking order. More than a week after the landing, Dr. Shoemaker—PI for all lunar geology and rock collecting—still had not officially received any of the photos taken on the moon, though he was supposed to figure out precisely where the rocks were picked up. His group was 14th on the priority list, far below the press.

Dr. Shoemaker got his first photos from Jules Bergman, ABC science editor, and with this and other information he was able to tell the mission controllers just where the spacecraft had landed—an unexpected dividend; the rather hairy landing had left N.A.S.A. mappers puzzled.

The geologists and other scientists were then eager to talk to the astronauts. Not until August 6, however, 13 days after splashdown, were they given access to the fliers for a scientific debriefing. They then got three hours to discuss the astronauts' field geology, their experience in setting up a seismometer and laser retro-reflector and other matters. There was no time for any relaxed give-and-take, only for a set of carefully planned questions and succinct answers. As a result one impatient scientist found the proceedings so "dull" he got up and left.

In summary, the scientists had hoped for fresh impressions and answers to many questions, both by radio during the long return from the moon and in the debriefing. Mainly, they got impressions eroded by time.

The Frustration of the Scientist-Astronaut

As long ago as 1963, Harold Urey warned: "An astronaut, if he is going to be worth anything at all on the moon, should have the knowledge of a first-class geologist. He should have a Ph.D. degree from a good university and several years' experience in hard-rock geology, geophysics and current lunar theory."

N.A.S.A. named six so-designated "scientist-astronauts" in 1965 and 11 more in 1967. Nine had Ph.D.s in physical science, including just one geologist. ("There were no more qualified geologist-applicants," a spokesman explained.) Five were M.D.'s or physiologists or both. Three had engineering doctorates. Another astronaut, an ex-Navy jet pilot named Don Lind, won his doctorate in physics from Berkeley in 1964 (with a strong unofficial minor in geology). So he can fairly though not officially be called a scientist-astronaut.

As of late summer, only geologist Harrison Schmitt was believed by Houston insiders to have a "first-class chance" of making an early lunar landing. Lind, though regarded highly throughout much of N.A.S.A., was pessimistic about his chances. N.A.S.A. headquarters in Washington insisted that scientist-astronauts "will" be making moon landings, starting with Apollo 16 or 17 "if" the act of landing is well enough mastered by then. Thus there has seemed to be some difference over the scientists' prospects between Washington and Houston's crew and astronaut office, which is test- and military-pilot-oriented.

It may be that a set of scientist-astronauts will make lunar landings after all. But if so, one can be sure that there has been a good deal of battling behind the scenes. The fact also remains that scientists were first selected for manned space flight four years ago. None has yet flown. A few have resigned. There is much unease among these men, who no longer have time to be scientists, and have not yet been given a chance to be fliers.

How about the other astronauts? If our men on the moon are not in large part to be scientists, they should be as skilled as possible in at least Dr. Urey's "hard-rock geology." Many of the astronauts, it is true, have worked long and hard at this discipline and are considered by geologist-teachers to have "almost the equivalent" of Master's degree training. Gene Shoemaker nonetheless says: "The astronauts are very smart guys. They did an incredible job on Apollo 11, more than anyone expected. We are all very grateful. But they are still not professional geologists." Shoemaker and others would like to see all lunar astronauts get still more geology, including independent field exploration and problem-solving. In view of other training demands, such wishes are will-o'-the-wisps.

Possible Tools for Lunar Science

Lacking scientists, and particularly geologists or geophysicists, on every mission, the field equipment to be carried becomes vital. For maximum exploration and payoff on Apollos 12 through 20, scientists generally want: (1) a more mobile space suit; (2) a rover vehicle to carry scientists and samples over distances men cannot walk; (3) an automated system for "documenting" lunar samples.

The more mobile space suit—so men can reach to the ground, for example, without using awkward tongs—is now not scheduled until 1971, if then. A rover vehicle to carry men and rocks is called "possible" by Apollo 17 at earliest, according to one N.A.S.A. official, but possibly it is not to be scheduled at all if it proves too expensive.

"The vehicle everyone wants," says one scientist, "is an automated vehicle, to be left behind on one flight, sent on a TV-guided traverse with an automatic scoop to pick up samples, then sent to a point to meet astronauts on the next trip." Neither this concept nor a simpler one is yet "in the program." One well-informed scientist says, "It's another case of scientific priorities and budgeting always coming last."

As to automatic "documenting," Dr. Shoemaker has been pushing "a system to make the man incredibly efficient," to consist of a little laser-ranging device mounted on the landing craft to keep track of where he walks, and a kind of wand with a TV camera and stereo camera—so he can just point at what he sees and record it while expert geologists on the ground monitor the field trip and say "pick this up" or "photograph that." The TV, laser and stereo photos provide the permanent record.

The difficulty, scientists testify, is "getting such new ideas and devices into the system. The manned space system resists change. And the people who really run it really don't think science is very important."

Enter here a final factor—flight timing. It takes time to build science hardware—or flight hardware—and to train crews. The N.A.S.A. schedule as of late summer called for nine more Apollo flights beginning in November, one every four months immediately after Apollo 11, with the schedule slipping after a bit to every five months. To help get the desired hardware into the flight sequence—and help plan the right kind of exploration—most scientists would like to see flights every six months at most, or even every nine.

They concede that flight planners have legitimate concern for keeping men and machines ready. But they argue: "We have now achieved our national goal in landing men on the moon. Now there is no really good reason for spending more dollars to go back unless we use the money to learn all we can. Flying too often gives us too little time to examine returned samples, then intelligently plan the next steps."

Science Now—or Mars Next?

This whole argument between scientists and flight planners has done N.A.S.A. leaders little good in their fervent desire to follow the grand Apollo program with an even grander future goal: manned flight to Mars. Rather than bother with painstaking scientific exploration of the moon, many men of N.A.S.A. would far rather move quickly to bigger and better manned missions—to a great space station first, then Mars.

But one scientist said: "How can anyone even talk of sending men to Mars when we can't yet get N.A.S.A. to do the best possible science on the moon?" Given other current social, educational and scientific demands on the Yankee dollar, few scientists would complain today if there were no manned space program whatsoever, and all space exploration of the moon, space phenomena and planets were performed by unmanned probes and satellites.

Scientists from all over the country working in Houston's Lunar Receiving Laboratory after Apollo 11 said: "We didn't ask N.A.S.A. to send men to the moon. We're glad they did—men can do *more*, we think, than the most sophisticated devices. But very few scientists would argue if the nation greatly cut down the manned program, *if* a vigorous unmanned program remained."

Since last summer, words and words have been written and spoken within and without N.A.S.A. circles to try to settle this sometimes ill-named "scientist-*vs.*-engineer" argument. Scientists and N.A.S.A. officials have met and re-met, and there have been many new N.A.S.A. promises and assurances of future cooperation.

All very well. The proofs will be in the flying, the equipment, the flight schedule, the job done. And all these will require the help of good scientists, within and without N.A.S.A., seated as co-equals in planning sessions. The recent resignations have made it harder than ever to hire good in-house men.

During some of N.A.S.A.'s past troubles—when some N.A.S.A. officials (like any officials) have made less than candid statements—some journalists have claimed that N.A.S.A. really stood for "Never a Straight Answer." This is not entirely fair. N.A.S.A. officials, like any officials, see events in their own special light; N.A.S.A. has operated with unusual openness and candor most of the time.

So N.A.S.A. may or may not sometimes mean, "Never a Straight Answer." But if the agency does not link itself closely with the search for nature's facts, it could come to mean, "Nary a Scientist Aboard."

Victor Cohn is Science Editor of the Washington Post. *His reports from the national capital will appear regularly in Volume 72 of* Technology Review.

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The MIT Press Cambridge, Massachusetts 02142

An Uncertain Sound

Technology Transfer

The Role of Federal Agencies in Technology Transfer
Samuel I. Doctors
Foreword by Harvey Brooks
Cambridge: M.I.T. Press, 230 pp., $12.50

Reviewed by
Bruce S. Old
Senior Vice-President
Arthur D. Little, Inc.

This book is the first in the field and presents a very useful review of federal agency activities in technology transfer, defined as "the process whereby technical information originating in one institutional setting is adapted for use in another institutional setting". The book is replete with references and provides a useful background for workers in a field which is surely growing in importance.

The reasons for the growing interest in technology transfer, not only among scientists and engineers but also among government officials, are simple to state. The federal government is the source of 65 to 70 per cent of U.S. research and development funds, and the continuance of such funding by the Congress will probably depend to an increasing extent on our ability to relate the true contributions of science and technology to our economic growth, and to the economic growth of less developed nations receiving A.I.D. assistance. There has, to date, been little research on the effect of technology on economic growth or on the mechanisms of technology transfer, but there is a gnawing feeling among the practitioners of the arts that we can vastly improve the return on our investment in research and development through better understanding of the complex processes involved in science and technology utilization and their relation to economic and social well being.

The author presents a description of what each of some ten different federal agencies is doing in the field of technology transfer. Particular emphasis is placed on N.A.S.A., which has assumed a leading role. N.A.S.A. has no clear legislative mandate; its role seems to be more politically motivated, intended primarily to provide additional justification to the Congress for the high cost of the space program by trying to show how the U.S. economy has benefitted from space technology fall-out.

This effort has not been too successful, perhaps partly because the more sophisticated and less economically based the technology, the less closely it is likely to be coupled with rapid transfer to industrial utilization and economic return. Further, Doctors points out that much of the N.A.S.A. effort on the acquisition of data has been somewhat frustrating, and the Regional Dissemination Centers established have been primarily limited to library functions. Merely making technical reports available to industry does not in itself transfer technology. The personal contact required for the transfer of knowledge in the detail and for the adaptation needed to fit the particular case—and the entrepreneurial and marketing assistance also needed—have been severely lacking. The importance of altering federal patent policies is well presented.

Naturally, the first book cannot be expected to cover all facets of the problem, and the author properly calls for more research and experimentation on the subject. It might be useful to mention a few areas for further study:

◇ The federal government should give further consideration to the proper government focal points for technology transfer. The Department of Agriculture appears to have done an outstanding job in its field, but is the Department of Commerce not more appropriate than N.A.S.A. for dealing broadly with industry?

◇ The study of technology transfer and economic growth is probably even more complex when one extends the topic beyond that presented in the book and considers less developed areas typically served by A.I.D. programs. Here Murphy's Law seems to prevail: one must be prepared to have anything go wrong that actually could go wrong. One has to begin with a detailed planning step in order to attempt to avoid pitfalls. Then one has to consider such elements as cultural factors (degree of achievement-orientation and matching of individual and group goals), social factors (stability, willingness to undertake risk, future-orientation, patience in the solution of social goals) political framework (mechanisms and laws as well as leadership which makes possible the use of industry, government and universities in the attainment of national goals), human and natural resources, financial resources, educational institutions, and innovative leadership of the entrepreneurial type. Even the definition of the term changes; in this case technology transfer is incomplete unless it is viable in another culture, operated ultimately by local entrepreneurs.

◇ Light should be shed on the process of technology transfer by more study of industry as well as government methodologies. Eyeball-to-eyeball activity entailing the efforts of someone dedicated to the ultimate utilization of his idea against all odds is definitely a key factor to success. And how about monetary reward—how specifically do engineers respond?

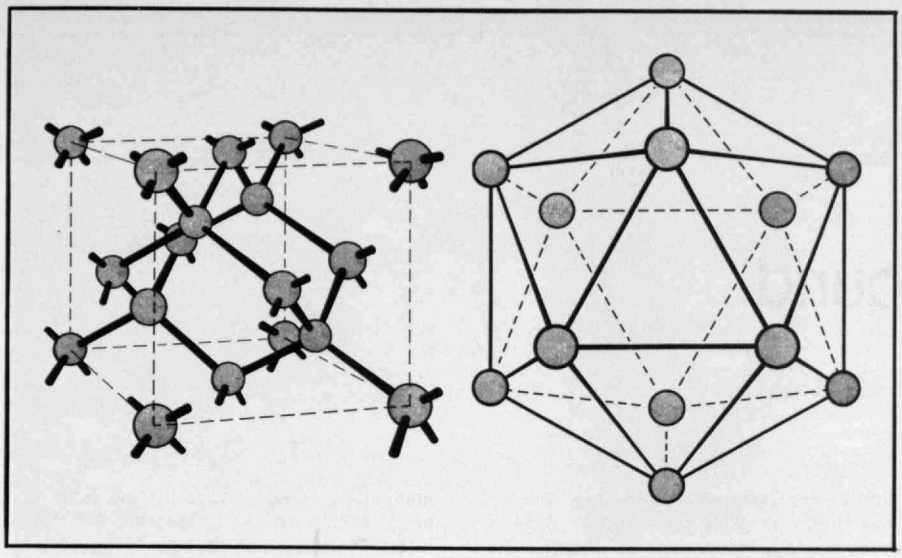
Doctors deserves credit for focusing frank attention on a topic which urgently requires multidisciplinary attack at this time and which will, doubtless, produce many equally worthwhile books in the years ahead.

The Spotlight—and the Shadow

Half-Way Elements: The Technology of Metalloids
Graham Chedd
Garden City, N.Y.: Doubleday and Co., 185 pp., $5.95 hardbound, $2.45 paper

Reviewed by
David Adler
Associate Professor of Electrical Engineering, M.I.T.

Half-Way Elements is an elementary non-technical exposition of the science and technology of six elements: boron, silicon, germanium, arsenic, antimony, and tellurium. The author, a natural sciences graduate of Cambridge University, is Life Sciences Editor of the *New Scientist.* The volume is part of the Doubleday Science Series, which includes such titles as *Water, The Weather Business, Spare-*



Atoms of the metalloids—"halfway elements"—link together in ways that represent compromises between the crystal structures of metals and the covalent molecular assemblies of non-metals, Chedd explains. "Silicon and germanium combine non-metallic and metallic properties by containing only covalent bonds but arranging them in such a way" (left) "as to form a crystal. . . . The repeated unit in a crystal of boron" (right) assembles into "giant molecules, with weaker covalent bonds—including a unique and extraordinary bond involving the overlap of three orbitals—holding the icosahedra in place."

Part Surgery, and *Living in Space.*

A peculiarity of the book is its strange choice of subject matter. Chedd chose the above six elements as metalloids, which can be defined as materials which are neither metallic nor nonmetallic. His choice seems arbitrary. The ostensible reason for picking these six is that their electronegativities, or the relative attraction of their atoms for electrons, are between 1.8 and 2.2, intermediate between metals and nonmetals. But a number of other elements have electronegativities in this range, including silver and copper, the two metals with the highest electrical conductivity of all, as well as phosphorus, mercury, and bismuth.

Another professed reason for the choice is that the aforementioned six are the only elements which are semiconducting, and this definition is the only important scientific mistake in the book. A semiconductor is a material whose electrical conductivity increases as the temperature is raised, as opposed to a metal in which the reverse is true. Although germanium, silicon, boron, and tellurium are indeed semiconductors, arsenic and antimony are examples of another class, also intermediate between metals and nonmetals, called semimetals. In these materials, the conductivity actually decreases with temperature. Also, another element, selenium, is usually considered a semiconductor, while bismuth and the low-temperature form of tin are semimetals. My personal preference would have been to define a metalloid simply as a semiconductor or semimetal, and to have included the interesting materials bismuth and selenium in the book.

So much for the pedantry. Given a book on six strange elements, this one makes for excellent reading. It is extremely well-written, contains informative diagrams and beautiful photographs, and should be understood by those with a modest technical background. The discussion of energy-band theory and the transistor are extremely lucid, and the explanations of involved types of chemical bonding are clearer than those that appear in most technical books on the subject. Except for the overworn comparison of an atom to the solar system, Chedd's similes are fresh and informative. For example, the placing of electrons around a nucleus is described as analogous to filling up single rooms from the bottom floors up, in an oddly-shaped hotel in which the first floor has two rooms, the second eight, etc. This analogy touches on minimization of energy, electronic-orbital theory, and the Pauli Exclusion Principle in an easily understood manner.

Interesting stories abound, and one can read about the Great Lancashire Poison-Beer Catastrophe of 1900 (traced to the arsenic produced during refining the sugar used in brewing the beer) and about the bizarre 15-year U.S. Air Force research project on borane-based jet fuels, the use of which would have released such large quantitites of poisonous boric acid into the atmosphere as to have increased present air pollution levels an order of magnitude.

The book deals not only with the technology of the pure material but with compounds of these elements, and one of the best chapters discusses the silicones, whose uses range from the "umbilical cords" of the Gemini astronauts to superballs and include biomedical applications such as a "brain drain", a tube which removes fluid from the head of a hydrocephalus victim, and a "Cleopatra's needle" which increases the mammary size of many topless entertainers.

The book closes with a look to the future; Chedd predicts a continued bleak existence for tellurium, the poor sister of the metalloids. This provides an ironic touch, since it now appears that tellurium is one of the most important ingredients of the amorphous-semiconductor devices which have provided the first major piece of technological excitement since the completion of the book. As the closing sentence notes, the shadows have a habit of harboring the unexpected.

The Marriage of Music and Technology: On the Rocks?

The Technology of Computer Music
M. V. Mathews
Cambridge: M.I.T. Press, 188 pp., $12

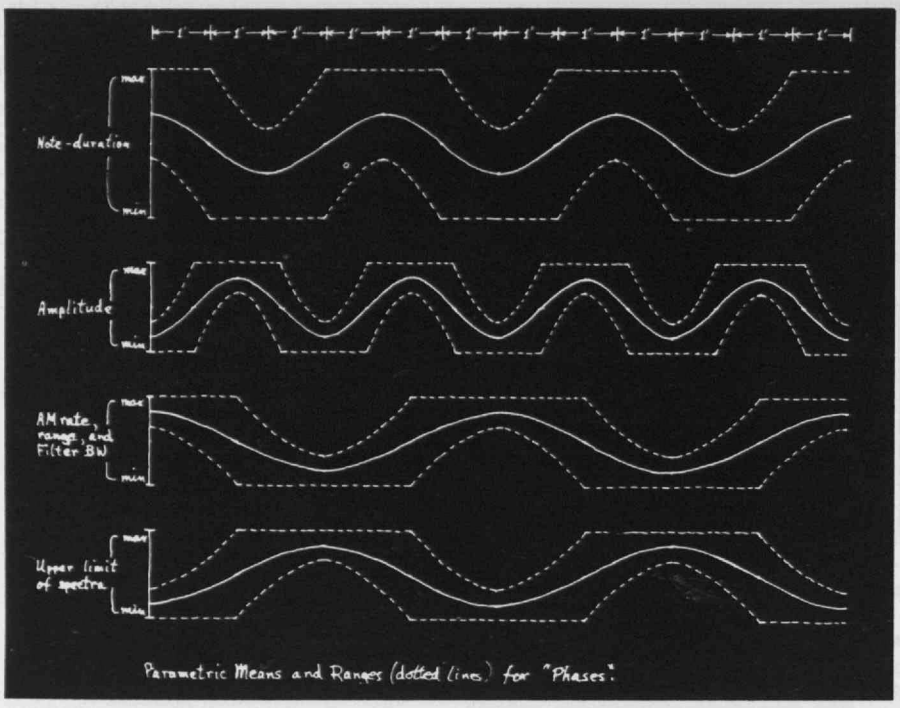
Reviewed by
Stephen W. Smoliar
Graduate Student
Department of Mathematics, M.I.T.

The Technology of Computer Music, by M. V. Mathews, is essentially a book of answers which has appeared at a time when artists are more concerned with questions. When H. F. Olsen introduced the R.C.A. Sound Synthesizer in the mid-fifties, the device was immediately snatched up by such composers as Vladimir Ussachevsky, Otto Leuning, and Milton Babbitt, who encountered many problems almost immediately. The major problem was one of time; unlike the piano or organ, the synthesizer was not "on-line" but rather processed a paper tape input. The coding procedures were such that it took hours to produce minutes of sound, and every composer who worked on the synthesizer probably experienced at some time the feeling that the device was just not doing what he wanted it to do.

Finally, beside these technical problems lay the aesthetic one, which Roger Sessions summarized at the 1960 Princeton Seminar in Advanced Musical Studies:

Limits of Infinity
"That electronic media will play a vital and possibly even decisive role in the future of music is not to be doubted. I must confess, however, to skepticism as to what that precise role will be. Two questions seem to me to be crucial. First of all, it is not sufficent to have the whole world at one's disposal—the very infinitude of possibilities cancels out possibilities, as it were, until limitations are discovered. No doubt the limitations are there, and if not there they are certainly in human beings. But the musical media we know thus far derive their whole character and their usefulness as musical media precisely from their limitations—stringed instruments derive their character and utility from not only the fact that they are stringed instruments, that the tone is produced by stroking strings, but

A "score" of computer music, prepared by James Tenney, a colleague of author M. V. Mathews, who has used Mathews' pioneering Music IV system extensively. The illustration shows a graphic description of the most important variable parameters used in the piece "Phases" by composer Tenney.



Parametric Means and Ranges (dotted lines) for "Phases".

from the fact that they are not wind or percussion instruments; and we have learned to use them with great subtlety of effect and power of expression because of that. The dilemma of electronic musical media is a little like that of the psychologist who is reputed once to have said to one of his friends, 'Well, I have got my boy to the point where I can condition him for anything I want. What shall I condition him for?'

"The other question has to do with the essential nature of music itself. Is music simply a matter of tones and rhythmic patterns, or in the final analysis the organization of time in terms of human gesture and movement? The final question regarding all music that is mechanically reproduced seems to be bound up with the fact that our active sense of time is dependent in large degree on our sense of movement, and that mechanical repetition mitigates and finally destroys this sense of movement in any given instance; it destroys also our sense of expression through movement, which plays so large and obvious a part in our musical experience. . . . It is the organic nature of movement as such, of the fresh and autonomous energy with which the performer invests each musical phrase, every time he sings or plays it, and which gradually disappears for our awareness if we listen so often to a mechanical reproduction of it that we become completely familiar with it, to the point of knowing always exactly what is coming next. It is more than the element of mere surprise; it is rather that if the expression of movement is to become effective, we require not only the evidence of movement from one point to the next, but a sense of the motivating energy behind it. . . .
In my own opinion, electronic media more than justify their existence if only by the new insight one can gain from them into the nature of sound. . . . But they raise the above questions and many others, and the questions will certainly become more acute as the media develop."

At the time Sessions was delivering his remarks, M. V. Mathews was just beginning his work in sound-synthesis by computer. Nine years later, his efforts have gelled into a full-scale system (Music V) as well as an earlier version (Music IV) which had been added to the facilities of the Princeton music department. *The Technology of Computer Music* consists of four virtually independent monographs concerning the Music V system: a general discussion of the problem of sound-synthesis by computer, a list of capabilities of the Music V system, a detailed documentation of the Music V program, and a thought-provoking article on the problems of psychoacoustics.

Music Left in the Wake of Technology

From a technological viewpoint, Mathews' system solves many of the problems ushered in by Olsen's synthesizer. Unfortunately, his book almost totally neglects any of the aesthetic problems, such as the ones posed by Roger Sessions. The result is a technically elegant little volume which handles the abstract problem of building a device with the capabilities of the R.C.A. synthesizer but without the inefficient operating procedure. Unfortunately, the musician (for whom the system was supposedly intended) is left behind in the wake of the technology. One wonders if Mathews would prefer to see music as a subdiscipline of computer science—saving his system for those who owe the computer due respect.

Probably, Mathews does not intend to be this extreme. From the very beginning, he asserts, simply enough, "This book is intended for people who plan to use computers for sound processing." However, as the reader continues, he discovers that he will need a certain sophistication in the fundamentals of computer programming and perhaps some basic physics and not-so-elementary mathematics. If he is a musician, he may very well hit a state of exasperation within the first ten pages.

It's not that Mathews doesn't try to communicate with the artist. In his first chapter, on the fundamentals of sound synthesis, he tries to explain some basic principles in terms of an ordinary hi-fi system. Nonetheless, these are but islands in a vast sea of technical jargon which will drown most curious artists.

The computer programmer, on the other hand, should have very little difficulty with the book. From the very beginning, he is presented with those problems he must take into account if he wishes to use his machine for sound synthesis, he is given a first-rate documentation of a sound synthesis program which already exists (and is coded in FORTRAN, a language which is practically universal), and he is provided with a step-by-step description of what he can do with the Music V system (and thus, a list of features which he might find desirable to implement in his system); and finally, the psychoacoustics essay reveals some of the problems of the gap between the desired result and the actual synthesis. In short, the book is ideal for any programmer of about a year's experience.

There is only one problem; the programmer who reads this book may not be a musician. Thus he may find himself in the same predicament as Sessions' psychologist: "I can make any sound I want on my computer. What shall I make?"

The "obvious" solution to such a problem would appear to be collaboration—coupling the technologist who can build the system with the artist who wants to use it.

Over the past several years, there have been many attempts at collaboration between artists and technologists. These have not precluded attempts by each party to learn the other's discipline, but unfortunately the results to date have not been very impressive. *Switched-On Bach* on the Moog synthesizer is a pathetic example of a new dog condemned to run the same old tricks, and even *HPSCHD,* the collaboration between John Cage and Lejaren Hiller at the University of Illinois, utilized the computer only for the preparation of tapes prior to the live performance, a task which probably could have been per-

formed with an ordinary synthesizer in just as much time.

Collaboration into Competition

The fact is that the marriage between art and technology, which had begun on a very optimistic and promising note, now seems to have found itself on the rocks; and both of the spouses are equally to blame. The major problem is that collaboration between artists and technologists doesn't seem to work on an equal basis—and sometimes it even degenerates into destructive competition. The resulting artistic products tend to verify that old joke about a camel being a horse designed by a committee; the end result is something which none of the contributing parties desired or expected.

What is needed, then, is a new breed of Renaissance man, equally adept in the disciplines of art and technology. This means that either the scientists will have to introduce art into their education or that artists will have to better comprehend the materials of electronic music. The latter is the more likely course of pursuit, since it was the artists who first decided that art should encompass electronic music. Indeed, in his lectures, John Cage has advised both that art should expand to meet the available technology and that it is essential that the artist know his materials.

Unfortunately, Mathews' book is probably too advanced for the artist who is willing to embark upon a study of the materials of computer music. What *The Technology of Computer Music* needs is a companion volume on the *art* of computer music. Such a volume could acquaint the artists with the materials of this discipline and could include the necessary rudiments of both hardware (the materials of electronic synthesis) and software (an introduction to programming, oriented with the artist in mind). The two volumes, as a pair, would then be fundamental to the artist who has the convictions and the desire to expand his capabilities to meet the available technology.

The International Future: Two Western Views

The Age of Discontinuity
Peter F. Drucker
New York and Evanston: Harper & Row, 394 pp. $7.95

The Chasm Ahead
Aurelio Peccei
New York: Macmillan Co., 297 pp. $7.50

Reviewed by
Leopold R. Michel, Visiting Lecturer, Graduate School of Business Administration, Boston College

The Sakharov Paper (*see* Technology Review, *June 1969*) gave us in essay form a Russian view of, and concern for, the future. Two recently published books by Western authors examine and describe in considerably more detail where and how changes will be felt in the next two or three decades and what, in the opinion of their authors, should be planned for.

Peter Drucker's *The Age of Discontinuity* provides—as its subtitle implies—"guidelines to our changing society" in the form of perceptive and penetrating discussions of major contemporary "discontinuities." In *The Chasm Ahead,* Aurelio Peccei, Vice-Chairman of the Olivetti Corporation and a member of the Management Committee of FIAT, begins with a concern regarding the technological gap between the United States and Western Europe, continues with a discussion of world "macroproblems," and appeals for long-range cooperative world planning.

To Make the World Truly Productive

"What do we have to tackle today to make tomorrow?" is Peter Drucker's inquiry—rather than the usual attempt at "What will tomorrow look like?" He examines those major breaks in continuity with the past which are visibly beginning to affect business, technology, economics, education, government, world relations and society:

1. The "knowledge technologies," which will be the growth industries of the coming decades;
2. The shift from an international to a world economy;
3. The "society of organizations," i.e. ,a pluralistic world society and polity of which organizations are the members;
4. The "knowledge society," whose arrival he considers the sharpest of the discontinuities.

New industries, formed on the twentieth century knowledge base, are not based on science alone but on a body of understanding of how knowledge can be applied and on experience of the "system" integration of the sum total. Drucker's discourse here covers the information industry (including computers); quite aptly he considers information as "energy for mind work". He also reviews what we know of the oceans, new materials and the characteristics of the "megalopolis" —each with the historical background.

With the approach of a world economy, Drucker examines the need for global money and credit and for a central bank, and questions whether gold can remain a reliable monetary standard. While this world economy is still in need of solid world-wide institutions, we have the International Monetary Fund with its special drawing rights, and there are a number of "multinational" corporations operating in terms of a world economy. What in Drucker's words, the world economy requires most is not making the poor wealthy but "making the poor productive." A review of developments in Japan, India and South America leads the author to a discussion of what will *not* work—such as development financed by agriculture—and to a conclusion that economic development of the poor parts of the world is workable not so much from philantropic motives as from self-interest on the part of the rich nations.

In the last part of the book—"The Knowledge Society"—Drucker reiterates that "knowledge", rather than merely science, has become the foundation of modern economy—its central capital, cost center and crucial resource. "To make knowledge productive" is the great management challenge. The role of the "knowledge worker," the related educational changes and political repercussions are presented in an objective and refreshing light. In his final question—"Does knowledge have a future?"—the author touches on the responsibilities, power and morality of the man of knowledge. He concludes that we need to apply our efforts in the areas of the discontinuities which are already present, rather than attempting to study major changes which are supposedly still to come.

The Gap Is "In Our Hearts and Minds"

Aurelio Peccei, the Italian industrialist, speaks with real global-missionary fervor. In *The Chasm Ahead* Peccei presents his concern about the increasing technological gap between the United States and Western Europe, particularly in aircraft, electronics, instrumentation, nuclear energy and telecommunication. With the closing of these gaps he hopes for Atlantic unity as the first great key to the future.

To resolve the global problems one must first understand the right direction of approach and attack; we must avoid the temptation of tackling what are really global problems in too local a context. Peccei presents his list of "macroproblems" for which truly long-range planning, with 10-, 20-, even 30-year goals, is essential: the race between food and population; supply of vital resources; control of the biophysical environment; psycho-social evolution; human fulfillment (education, culture and leisure); and the achievement of a philosophy of life (moral, ethical, spiritual).

To quote Peccei the humanitarian: "The greatest gap is in our hearts and minds." East and West, somehow blinded by their self-interest, success and relative well-being, should not continue on their separate ways. Beyond the Atlantic core Peccei envisions an expansion of planning to include particularly Japan; but he also invites the participation of Australia, New Zealand, the Caribbean area, the Mediterranean Basin and Eastern Europe. Following these, Russia and South America should join. The last planning phases would be devoted to Africa and Asia.

The Atlantic Community should lead the movement to "face the future, will the future and shape the future." This is natural, he says, since "the Atlantic people", amounting to only one-fifth of the world's population, account for two-thirds of the world's production.

Again showing his concern for humanity, Peccei talks about the deep malaise, the sense of frustration and lack of purpose, that exists today in the advanced societies. He feels that rejection of the pervading materialism may be a good omen in a world of moral distress. There is need for a transformation of our outlook on life, on man and society, and on the world.

Peccei considers the following three dimensions as a conceptual framework for planning. First, the "oneness of humanity": race prejudices, vested interests and much else of the traditional underpinnings of division must radically change. Second, the time element: the acceleration of history—which is man-provoked—requires that we must look further ahead than before. Man-made intrusions on nature have caused imbalances; man must now be the regulating factor—long-range planning is mandatory. Third, the complexity of modern life: it is impossible to deal satisfactorily with single phenomena without consideration of others, as everything interacts with everything else; system analysis becomes a universal necessity.

Peccei envisions that the leading nations begin the planning with an international board of ten to twelve members which would be able to work non-politically, without outside interference. Assisting such a Planning Board would be a "World Forum" of scholars, scientists, executives and experts.

Let us hope that in, say, 1975, a journal such as this will give us its "special issues" devoted to the actual accomplishments and progress of the Global Plan!

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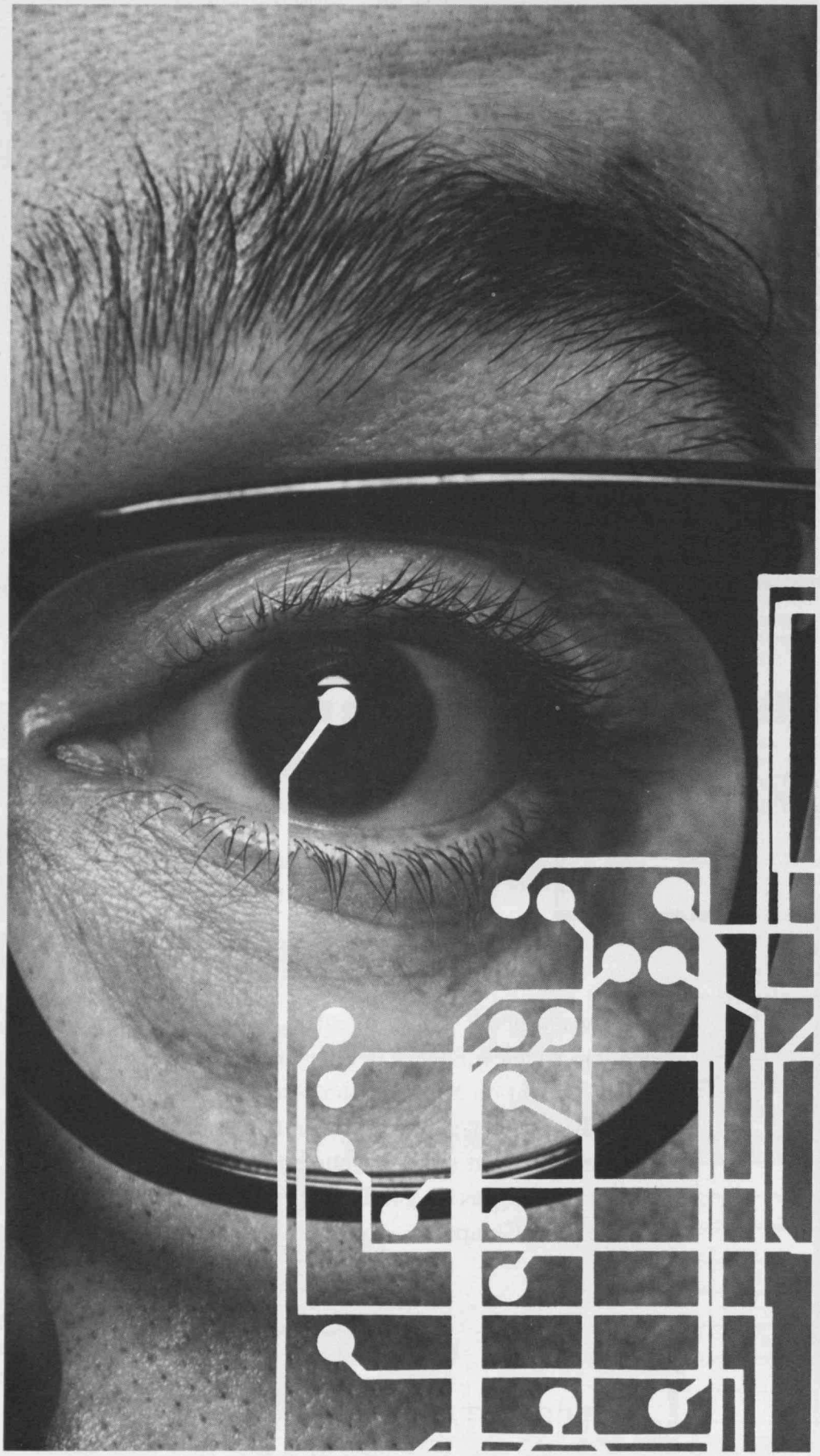

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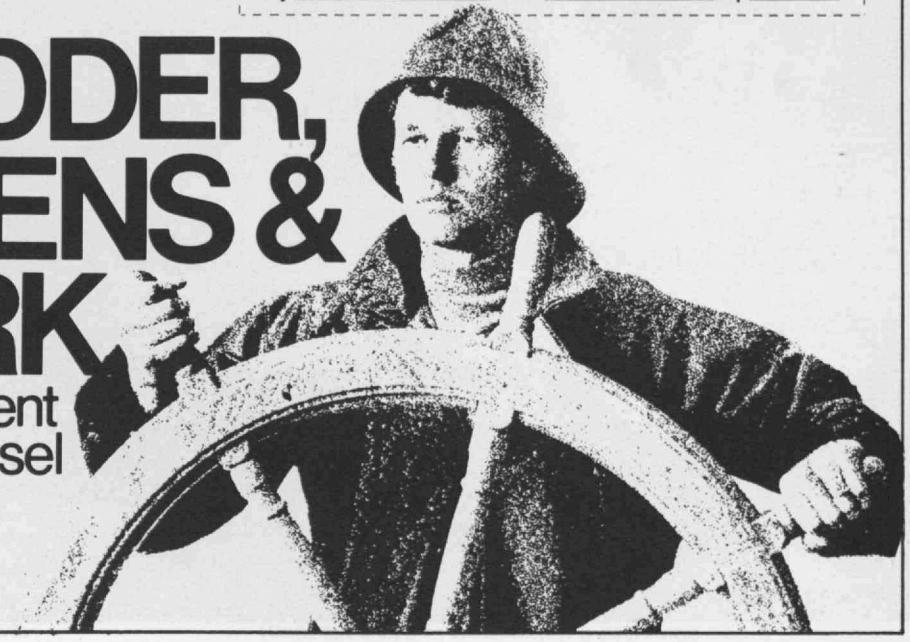


"In the process of creating wealth and improving man's immediate surroundings we have created problems of the environment which are only barely understood. Man is pressing harder and harder on the resources of his planet. We should take immediate steps to preserve it; man has nowhere else to turn." (Photo: The earth from 11,000 miles over the Indian Ocean—N.A.S.A. from U.S. Government Printing Office)

Man's technology is changing his physical environment in ways which are not clearly understood. The results could endanger man's future on earth

Gordon J. F. MacDonald
Vice Chancellor for Research,
University of California, Santa Barbara

The Modification of Planet Earth by Man

From the earliest times man has attempted to shape for his purposes the physical environment—the air, the water, and the solid earth. The first changes involved only his immediate surroundings and were provided by shelter and fire. In more recent times the vastly increased complexity of society has placed new requirements and burdens on the environment. Besides attempting deliberate changes in his surroundings for society's benefit, such as great dams and irrigation projects, man, aided by technology, has produced enormous waste products, with the atmosphere, oceans, and even the solid earth serving as repositories. In so doing he has produced inadvertent and, in many ways, undesirable alterations. In addition to the effects of the waste products, the purposeful change of the environment may place strains on situations which naturally are nearly unstable; these additional strains could in time magnify nature's capacity to destroy.

A summary of recent technological advances in understanding the planet earth leads to the following generalizations with regard to how man alters his environment:

1. Large-scale, man-made but frequently inadvertent, changes—in several cases only recently recognized—are taking place in the physical environment.

2. The magnitude of the changes produced by man is of the same order as that caused by nature.

3. The alterations can no longer be regarded as local. Vast increases in population, urbanization, agriculture, for example, have multiplied local effects many times over and made what were once considered confined and minor nuisances into global phenomena.

4. Our understanding of the physical environment is sufficient to identify inadvertent modification but it is far too primitive to predict confidently all the consequences of man's abuse of the planet.

5. Despite the very great long-term importance of understanding changes in our environment if we are to maintain a habitable planet, inadvertent as well as purposeful modification of the environment are neglected fields of research, neither fashionable to the scientists and engineers nor high priority to the money-distributing government agencies.

I will illustrate these generalizations by describing two problems—how man is changing the climate of the planet and how he is producing earthquakes. In this review, I will to some extent cover material that is controversial in the sense that not all the data are agreed upon. While the details may alter as new information becomes available, I believe that the general conclusions will hold. My purpose is to draw on several fields of geophysics in order to substantiate the central theme: inadvertent effects of man's activity could lead to catastrophic changes in the physical environment within a few decades unless these changes are understood and ways are developed to compensate for and avert the undesired effects.

Changing Climate

The climate has been changing with a time scale measured in decades. Climate is much too complicated to be described by a single parameter, but a useful guide is the temperature of the atmosphere measured at the earth's surface and averaged over a year and over the whole earth. Climatological data show that from 1880 to 1940 this average temperature increased by about 0.4° C. while in the last 25 years the average temperature has decreased by about 0.2° C. Associated with the increasing temperature were northward movements of the frost and ice boundaries, pronounced aridity in south central parts of Eurasia and North America leading to dust bowl conditions and strong northern hemisphere zonal circulation. In more recent times, the lowering temperature was associated with frost and ice boundaries shifting to the south, a weakening zonal circulation and marketed increases in rainfall in parts of the previously arid continental areas. The past year was no exception. Sea ice coverage in the North Atlantic was the most extensive in over 60 years. As a result Icelandic fisherman suffered great losses. In contrast, the rains in the central continental regions, particularly India, led to very high wheat yields. These experiences emphasize two further points about climate. The complex pattern of human activity is sensitive to relatively small changes in climate, but our ability to predict such changes is very limited.

Are the climatic fluctuations of the past 80 years due to the natural and as yet poorly understood changes in atmospheric processes, or have the activities of man intervened in some subtle way? There are at least six ways in which man's activities could perturb

the atmospheric heat balance and thus the climate in a significant way. These are:

1. increasing the carbon dioxide content of the atmosphere by burning fossil fuels,

2. decreasing atmospheric transparency by aerosols resulting from industry, automobiles, and home heating units (urban pollution),

3. decreasing atmospheric transparency by dust put into the atmosphere as a result of improper agricultural practices (agricultural pollution),

4. direct heating of the atmosphere by burning of fossil and nuclear fuels (thermal pollution),

5. changing the albedo (the percentage of the incoming solar radiation directly reflected outwards) of the earth's surface through urbanization, agricultural, and deforestation,

6. altering the rate of transfer of thermal energy and momentum between the oceans and atmosphere by an oil film resulting from incomplete combustion and oil spill from ocean-going vessels (ocean oil pollution).

Of these, carbon dioxide pollution has long been recognized as potentially affecting worldwide climate. The possible effects of urban industrial and agricultural pollution on climate have only recently been noted, and there have only been speculations about the effects of ocean pollution, thermal pollution, and changing albedo.

Carbon Dioxide and Solar Radiation

Since the beginning of the century, there has been a world-wide increase of carbon dioxide from an average concentration of about 290 parts per million (p.p.m.) to the present value of 330 p.p.m., with the increase being fairly constant in time. The magnitude of the observed increase is approximately that expected due to the increased consumption of fossil fuels.

Various attempts have been made to calculate the effect of carbon dioxide on the average surface temperature. The energy which drives the atmosphere and determines climate is derived primarily by the absorption of visible solar radiation by the earth's surface and atmosphere. The absorption of that energy tends to raise the temperature of the surface which maintains its thermal balance by re-radiating energy to space at longer wavelengths. The absorption of incoming visible radiation by carbon dioxide is so small that changes in its concentration will have no appreciable effect on the amount of incoming solar radiation that reaches the surface. However, carbon dioxide is opaque to certain parts of the long wave radiation emitted by the earth's surface; changes in concentration of carbon dioxide change the heat loss by radiation at the surface. The size of the temperature change resulting from a change in concentration of carbon dioxide depends additionally on the water vapor concentration of the atmosphere and its cloudiness.

The most complete calculations of the net effect of altering the carbon dioxide content of the atmosphere are those of S. Manabe and R. Weatherald. They reported in the *Journal of Atmospheric Sciences* (1967) that the change in carbon dioxide content of the atmosphere between 1900 and 1940 was sufficient to warm the earth by about 0.1 to 0.2° C. The significant feature of these results is that the change in temperature that would be expected from man's activities is of the same order of magnitude but somewhat less than the observed increase of temperature (0.4° C.) during the first four decades of this century. What the calculations and observations do not reveal is whether man's activities are a principal cause of the change in world-wide climate or are superimposed on larger natural variability.

The decreasing temperature of the past two decades cannot be attributed to carbon dioxide, since its concentration continues to increase while the temperatures decrease. Is the observed decrease due to man or is it a result of whimsical nature that is now overwhelming the effects of carbon dioxide? The answer is by no means clear, but there is increasing evidence that urban and industrial pollution, perhaps aided by agricultural pollution, is in large part responsible for decreasing the surface temperature at a rate large compared with the effect of carbon dioxide in increasing the temperature.

Pollution by Particles

Particle pollution, whether urban and industrial aerosols or agricultural dust, can affect the thermal balance

in at least two ways, one direct and one indirect. The presence of small particles in the atmosphere decreases the transmissivity of the atmosphere to the incoming solar radiation. This partial shielding of the surface is usually described in terms of the turbidity of the atmosphere. The decreased solar radiation reaching the surface will lead to a lower temperature, but the small particles also affect the outgoing long-wave radiation. The net effect on the total radiation balance depends on the abundance, size, distribution, and altitude range of the small particles. Calculations of this net effect are still primitive; however, there are estimates that a decrease in atmospheric transparency of only 3 to 4 per cent would lead to a reduction of surface temperature of 0.4 ° C.

The indirect effect of particles introduced by man on the thermal budget of the atmosphere arises because air, particularly air that has been over the oceans for some time, is often deficient in condensation and crystallization nuclei. These deficiencies permit the water vapor to become supersaturated or the water to become supercooled. The introduction of man-made condensation nuclei into the atmosphere aids the formation of fog and low cloud layer from supersaturated air. In addition the artificially stimulated clouds will reflect some fraction of the solar radiation back out into space. The introduction of crystallization nuclei may under some conditions alter the precipitation processes.

Are More Clouds Forming?

The indirect particle effect of encouraging the formation of low clouds and fog further enhances the modification of the thermal balance. Low clouds have a large effect on the net energy reaching the surface; a unit percentage change in average low cloud cover the world over will bring about a decrease in temperature of 0.8° C., four times the observed drop in temperature over the past two decades. At present, on the average, about 31 per cent of the earth's surface is covered by low cloud; increasing this to 36 per cent would drop the temperature about 4° C., a drop close to that required for a return to an ice age.

There are few reliable observations of the turbidity of the atmosphere extending over long periods. Data for Washington, D.C., and Davos, Switzerland, indicate increases of turbidity of approximately 10 per cent and 20 per cent per decade, respectively, for the general period 1910 to 1960. A much larger change of 60 to 80 per cent per decade over the last 10 years has been recorded for an observatory at Mauna Loa. The observatory is at an elevation of 3398 m., and because it is remote from sources of local pollution it may give some measure of the changes of turbidity in recent times in the northern hemisphere.

While the local increases of fog and low cloud cover for urban areas are well documented, the overall increase of cloud cover, if indeed there has been one, is not known. Only with the availability of satellites have data been obtained on a fairly routine basis for the ocean areas, but these data are often incomplete since high clouds may hide clouds at lower levels and the perturbation in the thermal balance depends on the height distribution of the cloud layers.

There is certainly not a proven case that urban industrial and agricultural pollution are the principal causes of the recent cooling trend. What is significant is that the apparent changes in atmospheric transparency are sufficient to bring about the observed cooling of the earth's surface. Further, the direct effects on transparency can be amplified by increased formation of low clouds and fogs which greatly affect the thermal balance of the earth's surface. If this interpretation is correct, then we face an urgent problem of global climate control since atmospheric pollution is increasing at an exponential rate, and there are as yet no acceptable means of impeding this growth.

Thermal pollution does not yet appear to be a significant factor in determining world-wide climate though locally it can contribute to the observed higher mean temperatures of urban areas. However, it has been shown that the present artificial energy is now 1/2500 of the radiation balance of the earth's surface, and it would become equal to the radiation balance in 200 years if the present rate of increase of energy production were maintained. A faster rate of growth of 10 per cent per year rather than the present 4 per cent per year would reduce this time to 100 years. Since a 10 per cent increase in the radiation balance would raise the average surface temperature 10 to 20° C., thermal pollution could be of great significance in the coming decades.

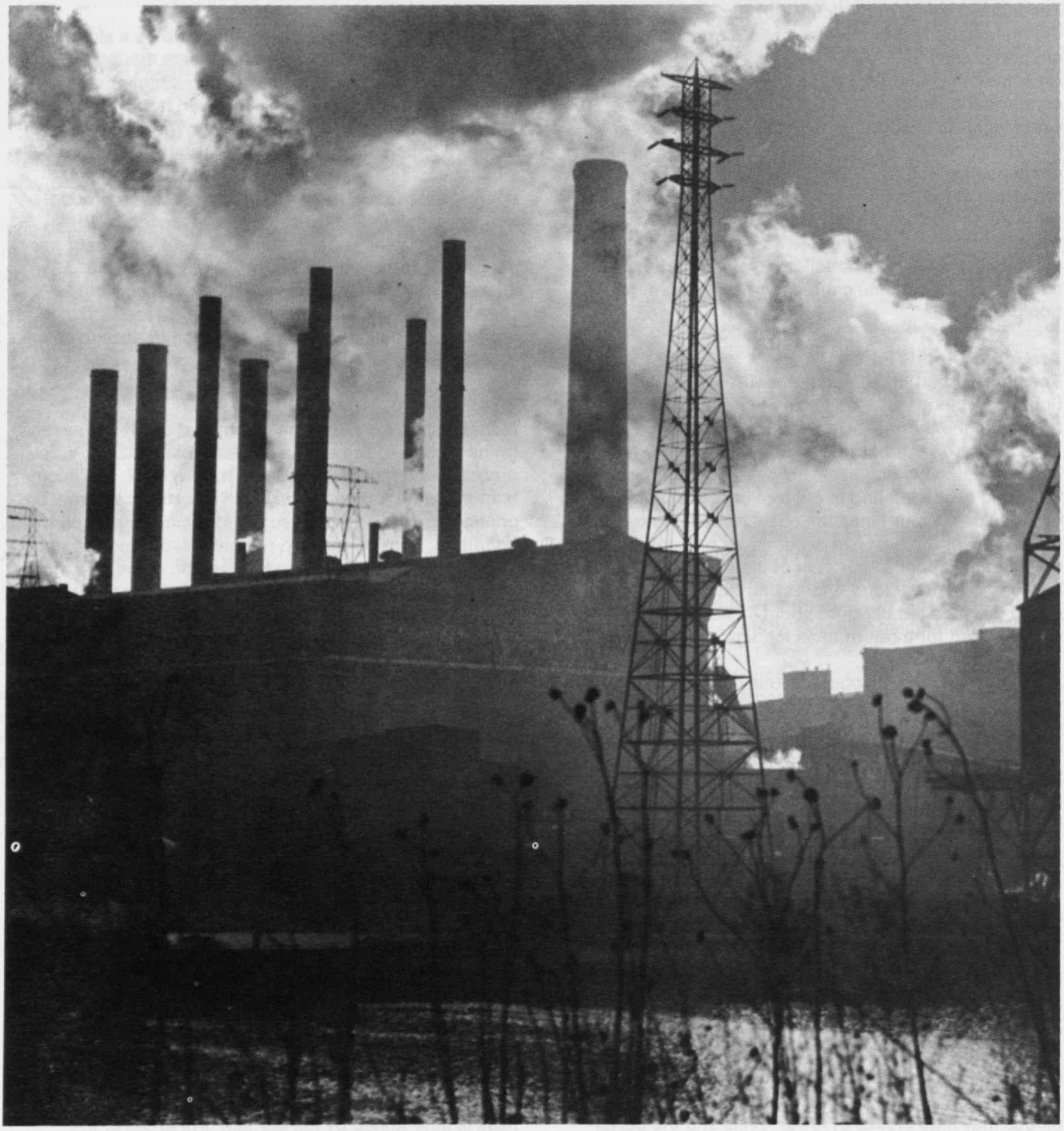
The Earth's Albedo

Manabe and Weatherald calculate that a unit increase in the albedo of the earth's surface will produce a decrease in average surface temperature of 1° C. Thus, man-made alteration of the earth's surface, if large enough, can bring about substantial changes in climatic condition. Densely built up regions have a higher albedo than forest or cultivated soils. Deserts, some of which may have resulted from man's activity, have a much higher albedo than grass-covered fields. While local changes in albedo have been measured, the long term global variation is unknown. The vast proliferation of urban areas and highway systems suggests that man may at present be increasing the surface albedo.

However, the net effect of surface change on the climate is not understood since changes in albedo are usually accompanied by alterations in the surface roughness. These alterations affect the rate at which the surface can interchange heat and momentum with the atmosphere by turbulent processes.

The possible effects of ocean pollution are poorly understood. It is generally assumed that the oceans, with their vast store of thermal energy, act as a balance wheel to climate. The atmosphere exchanges energy with the ocean not only through radiation processes but also through the mechanical processes associated with air moving over a rough surface. The strength of the mechanical interaction depends on the roughness of the surface at various length scales, and the roughness is determined by the surface properties of the

". . . There is increasing evidence that urban and industrial pollution, perhaps aided by agricultural pollution, is in large part responsible for decreasing the surface temperature of the earth at a rate large compared with the effect of carbon dioxide in increasing the temperature."



water as well as by the velocity and irregularity of the wind blowing over the surface. Very thin oil films can perturb the interchange by reducing the turbulent flux of heat (and momentum), reducing evaporation and lowering the radiative emissivity of the surface.

We do not know whether ocean pollution is a significant factor in climatic change. Data on the extent of oil pollution, the lifetime of an oil film on the sea surface, and the detailed thermal effects of such a film are not available, so even the sign of the effect of ocean pollution on the earth's surface temperature is not known.

I have briefly reviewed six major ways in which man could be altering the planet's climate; there may be others of comparable importance such as contrails from jets and supersonic aircraft. Carbon dioxide pollution leads to an increase in temperature at a rate similar to that observed in the early part of the century. Particle pollution acts in direction opposite to carbon dioxide; the magnitude of its effect is not known but could be large. Thermal pollution is as yet insignificant but will in a few decades enhance the warming tendencies of carbon dioxide pollution. The magnitude and even the sign of man-made changes in surface albedo are uncertain but on net may be reinforcing the cooling brought about by particle pollution. Even more uncertain are the effects of ocean pollution. In summary, we do not know positively by how much and in what ways man is changing his climate, but clearly the possible effects are of the same size or larger than the variations observed in the past. This present lack of understanding makes impossible any confident prediction of future man-made alterations in climate. The present changes could produce further small scale fluctuations in climate or there could be in a few decades the beginning of a new ice age.

The Lack of Research

The present level of effort in the United States on the problems of atmospheric modification is remarkably low. During the First National Conference on Weather Modification held in Albany, New York, in April, 1968, some 64 papers were presented. While several of these dealt with basic research relevant to the problems of modification due to pollution, only seven directly addressed such questions. In the fiscal year 1967, the federal government provided $9.9 million in grants and contracts supporting research in weather modification. Of these monies, about $100,000, or 1 per cent, supported research in inadvertent modification. If all the government programs in the atmosphere are examined, at most a few per cent support research or operation in unintentional modification.

I believe urgent action is required if society is to deal responsibly with the long-term problems of climate alteration. These actions include the following:

1. There should be world-wide recognition both at the national level and within the United Nations of the long-term significance of man-made alterations in climate.

2. World-wide programs should be developed for ground monitoring of atmospheric turbidity, carbon dioxide content, and water vapor distribution with particular attention to oceanic areas. The ground-based observation should be supplemented by airborne monitoring of the number density, size distribution, and composition of the particulate matter in the atmosphere. Such programs are essential first steps to establishing base levels of pollution against which changes in the decades ahead can be measured.

3. Satellite programs should be developed to continually monitor, on a global basis, cloud cover and heat balance of the atmosphere. There should be a continuing program for measuring surface albedo with particular emphasis on changes brought about by man-made activities.

4. The federal government should place much greater emphasis on research in problems of inadvertent modification. Such research should examine not only the question of monitoring parameters affecting climate but also the construction of more adequate models of the thermal and dynamical processes within the atmosphere and at the boundary between the atmosphere and the solid earth and oceans.

Man-Made Earthquakes

I now turn to the problems of man's inadvertant modification of the solid earth. While our understanding of the processes affecting climate is limited, it is vastly greater than our understanding of the processes that shape the earth's interior. The accessibility of the atmosphere to observation, its great importance to commerce, its relative physical homogeneity, all distinguish it from the earth's interior, about which we can learn for the most part only by indirect observation. Yet it has become clear in recent years that man by his activities has changed conditions in the near surface layers of the solid earth. These changes have brought about release of elastic energy which had been built up by tectonic forces acting over geologic time. The energies released in some events were large enough to cause substantial damage; if similar releases occurred near a highly industrialized region, disaster would result.

That the construction of a dam with consequent loading of the earth's crust can produce seismic disturbances was first documented in 1945. Lake Mead, formed by the damming of the Colorado River by the Boulder Dam, started to fill in 1935. No seismic activity had been recorded in the previous 15 years in the general area of the dam. When the water level reached a depth of 100 meters in September, 1936, the first small earthquake was detected in the near vicinity of the dam. During 1937, about 100 small earthquakes were actually felt as the water level continued to rise. With the installation of seismographs in 1938, thousands of events were recorded. As the normal level of about 160 meters was reached in May of 1939, the seismic activity reached a maximum with the largest earthquake having a magnitude of 5, which is large enough to cause some damage in a populated area.

D. S. Carder in 1945 interpreted the sequence of events

"The vast proliferation of urban areas and highway systems suggests that man may at present be increasing the surface albedo. . . . Thus man-made alteration of the earth's surface, if large enough, can bring about substantial changes in climatic condition."

in terms of the increased load of water, amounting to some 35 billion tons, reactivating faults in the region which had been inactive since the Pleistocene Era; Lake Mead is in what is generally regarded as an aseismic region.

In recent years, there have been a number of moderate earthquakes associated with the construction of large dams. The world's largest artificial lake, more than four times greater in volume than Lake Mead, has resulted from the blocking of the Zambezi by the Kariba Dam. The Zambezi runs along the border of Rhodesia and Zambia in a region in which no seismic activity had been detected prior to the construction of the dam. The filling started in May, 1960, and Rhodesian seismologists began recording earth shocks in the vicinity of the dam in January of 1962. The seismic activity reached a peak in September of 1963; a sequence of four large earthquakes, magnitudes 5.7, 6.1, 5.6, and 5.8, were felt on September 23. Two days later there was another of magnitude 6 which, while small compared with such great earthquakes as the Chilean of 1960 or the Alaskan of 1964, could cause substantial damage to an urban area.

The most recent large earthquake associated with a dam was recorded by seismographs throughout the world on December 10, 1967. As the 103-meter dam at Kogna, India, began to fill in 1962, small tremors were felt. A somewhat larger shock in June, 1965 led Indian seismologists to speculate that the crust had adjusted to the changing load of water. The earthquake of 1967, with a magnitude of 6.4, showed this to be a false hope; it caused more than 200 deaths at a nearby town and its damaging effects were felt throughout India.

Lake Mead, Kariba, and Koyna Dams are all located in areas relatively free of seismic disturbances. However, dams built in seismically active regions of Greece, at Kremasta and Marathon, have also been associated with magnitude-6 or greater shocks. In all cases the major shocks followed the filling of an artificial lake. The energy released in the shocks was greater than the elastic work done by the water loading of the crust. It would therefore seem that the water load created a strain field additional to that already present. The additional load triggered a release of the tectonically stored energy with almost all the released energy concentrated in a single large shock.

Man's ability to modify tectonic processes was again demonstrated in the Denver earthquakes. In this case, the injection of chemical waste fluids into an underground reservoir led to a sequence of quakes in an area where few if any seismic disturbances had been noted over the previous 70 years. The earthquakes started after the pumping of the fluid had commenced on a routine basis in March, 1962, and continued after injections were stopped in February, 1966. The three largest quakes, all with magnitudes 5 or slightly greater, took place on April 10, August 9, and November 26, 1967, and resulted in slight damage in Denver. The total energy released in the Denver earthquakes, about 5×10^{19} ergs, slightly greater than a kiloton explosion, was greater than the work done in pumping the fluid into the reservoir; the additional energy was drawn from that stored over geologic time by tectonic processes.

The detailed mechanism by which the earthquakes were set off is still uncertain; it would appear that, unlike the dam-loading cases, the mechanism did not involve directly changing the regional strain field. The fluid injection may have increased the interstitial water pore pressure, loosening previously locked faults. Motion along the faults could take place until blocked by a stronger lock point.

Observations to Conclusions

Observation on the sequence of events at Denver and various dam sites, as well as accumulating information on natural earthquakes, suggests the following generalizations relevant to the problem of man-made earthquakes:

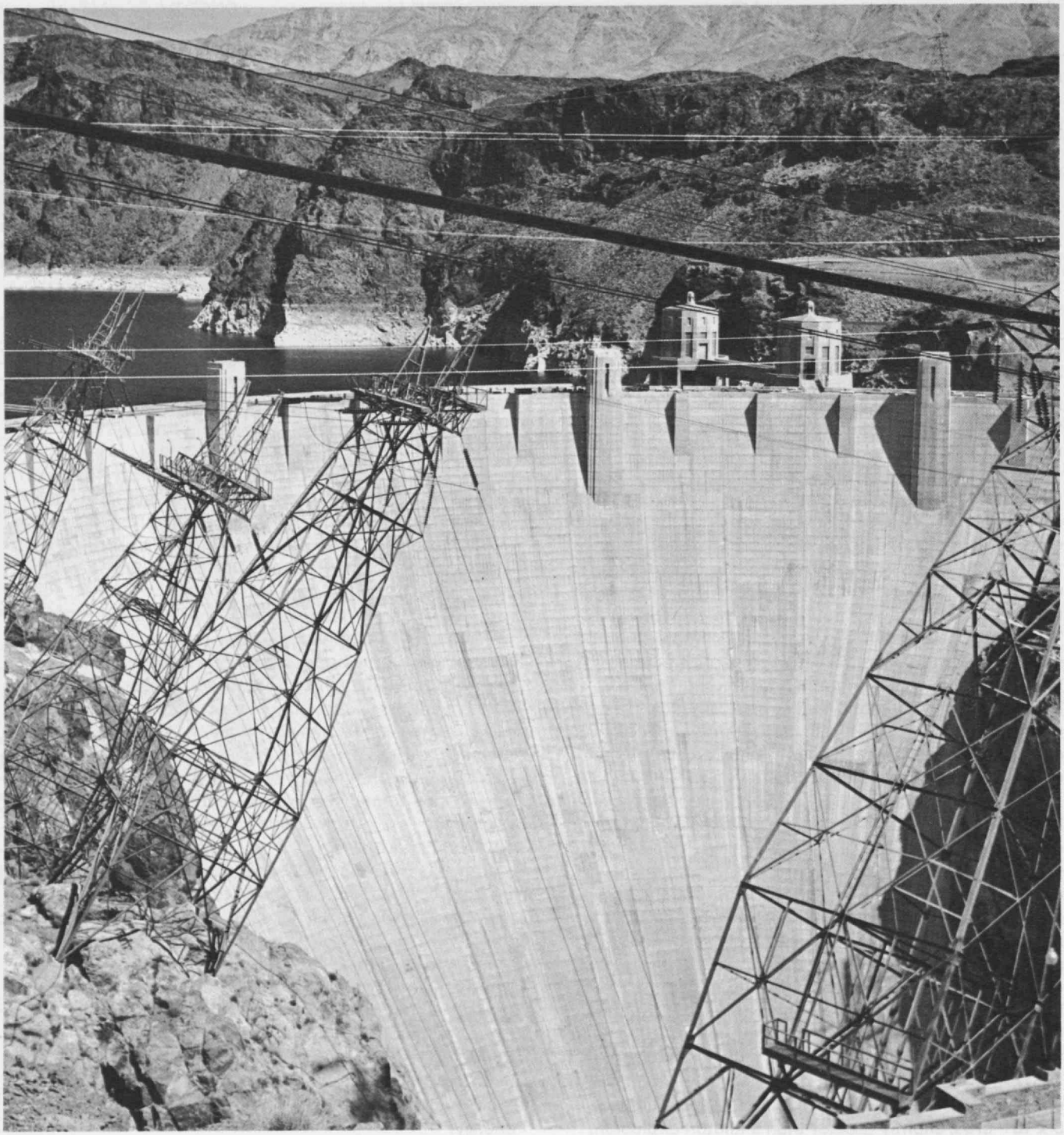
1. Geologic process acting over long periods builds up strain energy in the rocks of the earth's outer layers. The rate of build-up in seismic regions is greater than that of aseismic regions but lack of prior seismic activity in a given locality is no guarantee that the region is not under tectonic stress.

2. The outer crust is laced with a network of faults. Motion along any given fault is initiated when the stress field is sufficient to cause the weakest lock point on the fault to fail. Irregularities along the fracture surface as well as termination of the cracks can be thought of as lock points. The break may propagate until it is inhibited by a stronger lock point along the fracture surface. Movement along a given fracture surface can be initiated by weakening lock points (Denver earthquakes) or raising the local stress above the critical value required for failure (dam loading); it may be argued that dam building can also initiate fault movement by increasing underground water pressure and weakening locks.

3. A local movement along a fault leads to an overall readjustment of tectonic stresses. While the total strain energy of the region may decrease as a result of a given event, that event may produce higher stress fields at a distance. In the Denver and dam cases, a sequence of minor tremors preceded the larger shocks. Among natural events there are many cases where a sizable earthquake is followed by a second major earthquake in a contiguous region after a period of months or days. This delayed reaction phenomenon was clearly illustrated in the Chilean 1960 earthquake in which a 7.5-magnitude shock preceded the main shock, of magnitude 8.5, by 33 hours.

4. Even for the large shocks, the strain energy released is only a small fraction of the elastic energy stored within the rocks. For example, the Denver earthquakes extended over a region of some 50 sq. km. and down to depths of 5 to 6 km., yet at a stress difference for failure of 100 bars, as little as one cubic kilometer of rock would deliver the observed 5.0×10^{19} ergs of energy.

"The man-made disturbances resulting from dam construction are approaching the critical magnitude range, and there is a not-insignificant probability that a man-made event could set off a catastrophic earthquake."



5. The large natural earthquakes affect the strain field of the whole planet in a significant way. Thus the Alaskan earthquake, with a fault length of about 800 km., produced permanent strain in Hawaii at a distance of some 4,000 km. Movement along small faults can be expected to produce changes in the stress fields up to distances of several times the fault length.

Reasons for Concern

Why should these man-made earthquakes cause concern? There are not many large dams and these are usually placed at substantial distances from urban areas; the underground pumping of waste is not a widely used procedure. However, I believe there are several reasons for concern.

There is good evidence that the great earthquakes (magnitude 8 or greater) consist of a superposition of smaller (magnitude 6 to 7) events. For example, it is argued that the 1964 Alaskan earthquake was actually composed of a rapid succession of earthquakes of average magnitude 6.8. The man-made disturbances resulting from dam construction are approaching the critical magnitude range, and there is a not-insignificant probability that a man-made event could set off a catastrophic earthquake.

While the connection between man's activities and the Denver and dam earthquakes is clear, there may be more subtle effects not yet recognized. For example, in many regions of the world the ground water table has been lowered by tens of meters as a result of human activity. In California, a lowering has taken place of about 60 m. in an area of 100 km. by 300 km. and the mass of water lost is about 2.3×10^{11} tons or about 10 times the water dammed in Lake Mead. We do not know whether the resulting stresses or lowered fluid pressure have affected tectonic activity in Southern California. Underground nuclear explosions, either for weapon development or in the peaceful uses program, with equivalent magnitudes in the range of 6 to 7, are another possible trigger capable of releasing energy stored over the aeons. Indeed a sequence of underground shots designed to dig a canal might very well model the sequence of smaller earthquakes that make up the destructive great earthquakes.

The increasing complexity of society has made it much more vulnerable to the destructive forces of earthquakes. Damage to San Francisco in 1906 amounted to $250 to $300 million. The losses today from the same earthquake could reach several billion dollars and the loss of lives could be similarly greater.

As in the case of inadvertent modification of the atmosphere, man's tampering with the outer crust has received relatively little scientific attention. The total federal funding of research, development, and technical services in the earth sciences in fiscal 1967 amounted to $205 million. Of this about 15 per cent or $30 million were spent on studying the dynamics of the solid earth. Only a small fraction of the $30 million supported work on man-induced disturbances.

In view of the long-term dangers involved in altering the stress distribution in the earth's crust and the opportunities of preventing disasters if an understanding of earthquakes is achieved, several urgent actions are required. These closely parallel, in sense if not in content, the requirements for a long-term understanding of climate:

1. There should be worldwide recognition that man can intervene in geologic processes in ways that can be destructive.

2. While it is at present impossible to measure the absolute strain energy in rocks, it is possible to monitor changes in the strain energy distribution. At present this is being done in only a few localities and in an unsystematic fashion. A world-wide net of strain-meters will be required in the long term to monitor the changing stress patterns in the crust. In the near future much greater effort should be devoted to measuring strain, particularly in regions near active faults.

3. Any major project (large underground explosion, large dam, etc.) likely to alter either the strain field or the underground fluid pressure field should be carefully examined in terms of its possible seismic consequences. Any such project that is instituted should be instrumented and monitored so that a maximum of information about man's effect on the crust can be determined.

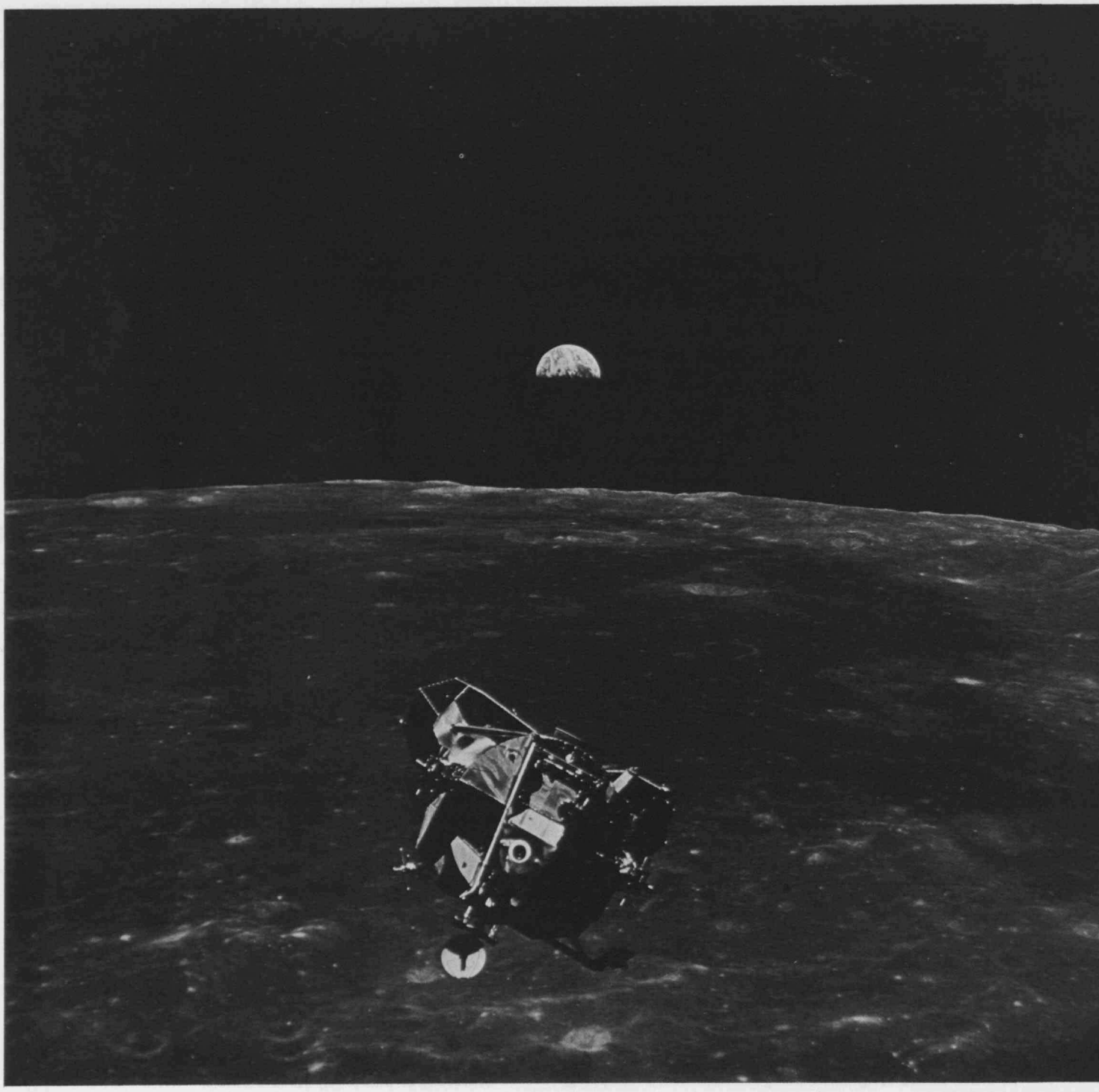
4. Basic research on near-surface crustal processes should be encouraged. This will involve not only monitoring of the relevant physical parameters but also the construction of numerical models of the processes of strain accumulation and faulting.

I have chosen only two areas of inadvertent modification to illustrate certain generalizations about the problem of man's alteration of his physical environment. What I have said about climate and earthquakes holds true to a greater or lesser degree in a number of other areas—modification of the shoreline (not only by pollution but by the damming of rivers), interference with the hydrological cycle through irrigation projects, and the alteration of stable slopes through unwise real estate development.

What we have seen in the past has been the great concern for using science and technology to create wealth. In the process of creating wealth and improving man's immediate surroundings we have created numerous problems of the environment which are only barely understood. Man is pressing harder and harder on the resources of his planet. We should take immediate steps to preserve it; man has nowhere else to turn.

Gordon J. F. MacDonald was trained in geology and geophysics at Harvard University, and he was a member of the M.I.T. faculty before going to the University of California (Los Angeles) in 1958 as Professor of Geophysics. Since then he has been Director of U.C.L.A.'s Atmospheric Research Laboratory, Associate Director of the Institute of Geophysics, and Chairman of the new Department of Planetary and Space Science before assuming his present responsibilities at the University of California, Santa Barbara.

". . . Voyages to the end of man's experience and into the beginning of space are . . . the physical embodiment of the modern age of mental exploration—the age of science. . . . In a land where minds and ships can roam beyond the reach of authority, tyrannical forms cannot endure." (Photo: N.A.S.A.)



The rewards of reporting an epic journey of man are more than the excitement of the moment. The audience shares new perspectives on another world.

Victor K. McElheny
Science Editor, *Boston Globe*

A Reporter's Moon Trip

I cannot remember just when I became convinced that men would land on the moon someday, just as I am now convinced that men will go on and land on other bodies in the solar system.

When I was a child, I gave no special thought to a lunar landing, because Flash Gordon and Buck Rogers (of the 25th century) already were making much longer journeys to imaginary planets. To be sure, the little books from the Hayden Planetarium said that one would be able to leap about remarkably on the moon, but they also told what your weight would be on Mars or Jupiter or Saturn.

A moon-trip definitely was real for me before President Kennedy in 1961 announced the national goal of a lunar landing in this decade (I remember asking myself then whether the nation was so self-doubting, so sick, that it needed such a tonic). When I visited Antarctica as a science reporter in November, 1960, it struck me that the glimpse I was getting of icy emptiness was the closest I would ever come to the feeling of walking on the lunar surface.

Often since then I have rolled that thought around in my mind, as a way of expressing the sense of the extreme which Antarctica gives. But I never was prepared for the familiarity of the view when the ghostly dots and lines from the little television camera on the moon spread across a screen in the large auditorium of the Manned Spacecraft Center near Houston, Texas, the night of July 20, 1969.

The Benignity of an Age of Science

It is to be present at events like the televising of the moon-walk and to write about them that I became a science reporter almost as soon as I graduated from college in 1957. I believe that events in science and engineering are the keys to the world in which I exist.

The first science story which truly excited me was medical. In Charlotte, N.C., where I was working at the time, I happened to see a closed-circuit television broadcast of an open-heart operation, in 1957 still an experimental procedure. A surgeon in Philadelphia, whose voice could be heard along with a kibitzing panel of leading heart surgeons, cut open the patient's chest to reveal a beating heart, throbbing about wildly in the open air. I reflected then that until open heart surgery had become practical, the largest number of such operations had occurred on top of a pyramid in the Aztec capital, Tenochtitlan, as religious sacrifices. But here a modern physician, with the confidence born of scientific knowledge, was operating on the heart to heal it, not tear it out. To do this, he stopped the beating with a drug and turned over the heart's functions to a heart-lung machine while he scraped out the coronary artery (a number of the panel thought the operation rather unlikely to be useful for long).

There it was, the spirit of experimental investigation linked to the desire to heal. I have never been cured of that image of the essential benignity of an age of science.

Sensing the Quality of Exploration

Despite the fact that a whirlwind of interest in space, set moving by Sputnik, also led to my finding a market for science reporting, I never saw a rocket-firing of any size until November 9, 1967, when the first U.S. Saturn V lifted off from Cape Kennedy, Fla., on a flawless first test of the moon booster.

It was only my third visit to Cape Kennedy. The first had been a brief Air Force Reserve trip aboard a DC-3 in 1962, just before John Glenn's three-orbit flight. (This was less than a year after Yuri Gagarin's one-orbit inaugural of the era of manned space flight—Will the Russians get a man to the moon as quickly after Apollo 11?)

A second visit to Cape Kennedy came on January 28, 1967, just a month after I joined the *Boston Globe* after three years' reporting abroad for *Science* magazine. It was the day after three astronauts had suffered an almost-instant death by suffocation in the cabin of an Apollo spacecraft intended for launch the next month. The atmosphere at Cape Kennedy was incongruous. In brilliant midwinter sunshine, a horde of reporters wandered around, searching for insights into what had happened. Many of them, like me, knew so little that they had nothing to contribute to the story. I had no engineer friends from whom I could obtain even fragmentary information. I hated the leaden, grief-filled atmosphere of rumor.

My only function, I decided, could be to resist rumors and remind readers that a huge system for going to the

This view of Mission Control at the Manned Spacecraft Center in Houston during the Apollo 11 flight suggests the multiplicity of information which is available to the technical direction of the mission. Much of that information—a veritable Niagara, says Mr. McElheny—is also available to the press in the adjoining press room. (Photo: N.A.S.A. from Wide World)

moon had been constructed, that such a system could not be perfect, and that its momentum would be slowed but not stopped by the deaths of three astronauts, Virgil Grissom, Edward White and Roger Chaffee. I was helped to make this point when Richard Lyons, then of the *New York Daily News* and now of the *New York Times,* showed me an account of remarks made the previous month by Joseph Shea, then Apollo Spacecraft Manager in Houston, in which he noted that some 20,000 failures had showed up during the preparation of the first Apollo spacecraft and that at some point a space engineer, like any other, had to decide when things were good enough.

The weekend thus gave me my first taste of the immense difficulty of covering the moon-flight program—or even of achieving much sense of the quality of what was going on. The program was too huge and too important for me to grasp its many operations easily, or to permit of easy access to important places or people.

This does not mean that the program of the National Aeronautics and Space Administration is some sort of deep dark secret. To be sure, the agency has hundreds of public relations people, under the overall management of Julian Scheer, who has the rank of Assistant Administrator for Public Affairs. But it is not the job of these people to keep N.A.S.A.'s name out of the papers. Quite the reverse.

The justifications of N.A.S.A.'s program are unusual—some would say shaky. It may be that going to the moon is inevitable, but many people argue against the urgency of doing it this decade, or even this century. The existence of a large "constituency" for N.A.S.A. in states like Florida, Louisiana, Texas and California where there are big agency installations or contractors' factories is not sufficient shield. The pathway to continued popular support that has evolved is an outpouring of news releases and briefings and tours that is simply stupefying. There is danger of drowning in the thousands of pages of releases and the dozens of hours of briefings.

Such an outpouring is not merely "news management." It could not have continued for a decade unless somebody out there—a sizeable fraction of the people of the world—were interested.

Information and Insulation

It is this Niagara of information—making the U.S. space program so public that it turns out to be a secret, hidden like the vital piece of paper in Poe's "The Gold Bug" by being displayed in the open—that is the real problem of covering trips to the moon, not N.A.S.A.'s occasional attempts to conceal possible political implications in the award of a large contract or to play down the seriousness of a rebuke to such a contractor for sloppy work.

But during an Apollo mission, the flood of information is vitally useful. With trifling exceptions, the entire volume of chatter between the astronauts and their controllers on the ground is made available, at first "live" over loudspeakers (or wires into stereo headsets) and then in the form of mimeographed transcripts made available within two hours of the time of the actual transmission.

At least twice a day, the flight controllers for one of three eight-hour shifts in Mission Control meet the press for questions about events during their shift. A reporter can attend such a briefing and ask his own questions; he can listen in from his desk in the nearby newsroom while looking at closed-circuit television; or he can tune in to the briefing over a local FM station which breaks into its running music program with all important Apollo mission transmissions, including briefings. If the reporter is trying to catch a meal or possibly some sleep, depending on his own deadlines and the sleep-work schedule of the astronauts, he can always fall back on the mimeographed transcript of the briefing.

As a further check on the accuracy of his own ear and also that of the relays of secretaries who make the transcript (there is a tendency for the secretaries to launder the text a bit, despite repeated injunctions from the press), the reporter can either record the transmissions himself on his own portable tape recorder or go into N.A.S.A.'s news office and listen to its tape of the proceedings.

All of this means that a reporter covering a moon flight

is rather insulated from the quality of the event; and unless he takes care, he may easily fall out of sympathy with the environment and thus allow his copy to go stale. A great deal of time must be spent chained to a work table listening to current transmissions while studying the transcript of past transmissions and briefings; going to briefings; and returning to the work table to write stories which are either dictated to the home office over a telephone specially installed at the table for the duration or over nearby pay telephones (often in short supply) or, page by page, over teletypewriter circuits.

After all this, the reporters retire to nearby restaurants and bars in small clannish groups to interview and tease each other according to an elaborate code that is too amorphous to describe.

In such an environment, glimpses of real-live space men, or even of the moon up above, are fleeting.

One means of penetrating a little deeper into things is to use the little telephone on the work table to call up space officials you know and ask them questions. Another is to go see them, either by making a formal request to do so or by direct arrangement. Still another is to take somebody out to dinner at a restaurant well away from the space centers. Better still is to try to arrange interviews with key people at quiet moments when they are not too busy. But most of the time, reporters with deadlines to meet must be content with a hurried personal question asked immediately after a briefing.

With all this to do, reporters also find themselves in fairly continuous contact with their home offices, which want to know what stories the reporter plans to write, what their leading points are, and why the reporter hasn't included a particularly sensational point already available from the wire services. I think it's fair to say that the people who receive the largest number of phone calls are the reporters from the *New York Times,* and it is certain that the phone calls are not always appreciated.

"Sometimes You Can Push Too Far!"

In such a fevered climate, there isn't much room for spontaneity. I am reminded of how the same issue surfaced in 1959 on the Iowa farm of Roswell Garst when a horde of several hundred reporters, Harrison Salisbury in the lead, chased Nikita Khrushchev and Garst across the cornfields.

There is the story that Garst was so annoyed at the tension and the crush that he found time to kick Salisbury in the shin. Somehow, that sort of thing sticks out in an affair as managed as a Soviet leader's visit—or a moon flight—must be. The equivalent event during Apollo 11 came early on the morning of July 21, just after the moon walk, when Julian Scheer angrily ordered a television camera which was focusing straight at a bunch of sweating reporters frantically beating at their typewriters to be removed from the newsroom. When the camera would not move, the Assistant Administrator for Public Affairs angrily shoved a technician out of the way and began moving the camera, which was still on.

At many points during the flight, it was the custom of television newsmen at Houston to use the busy background of the newsroom during brief newscasts from the Manned Spacecraft Center. But this particular camera had been in a main aisle on an unusually crowded and tense evening for a long time. Immediately under the lights was a group from the French newspaper *Le Figaro* (which very kindly printed an essay about Apollo 11 which I wrote for the *Globe* but which it did not have space for). The French reporters, led by the capable Ann Thinesse, uttered not a word of protest. Ann continued to work on one of her sober, stylish dispatches in longhand. But meanwhile, a technician was telling Mark Bloom of the *New York Daily News* to bend down out of the way of the camera and when he wasn't quick enough about it the technician said, "Sometimes you can push too far, buddy." Mark thought so, too. He hit the ceiling and went off screaming, something he almost never does, to Scheer. Scheer then acted, to the inexpressible delight of the writer-journalists looking on. One "big eye" flickered shut, if only briefly.

Affirming the Events

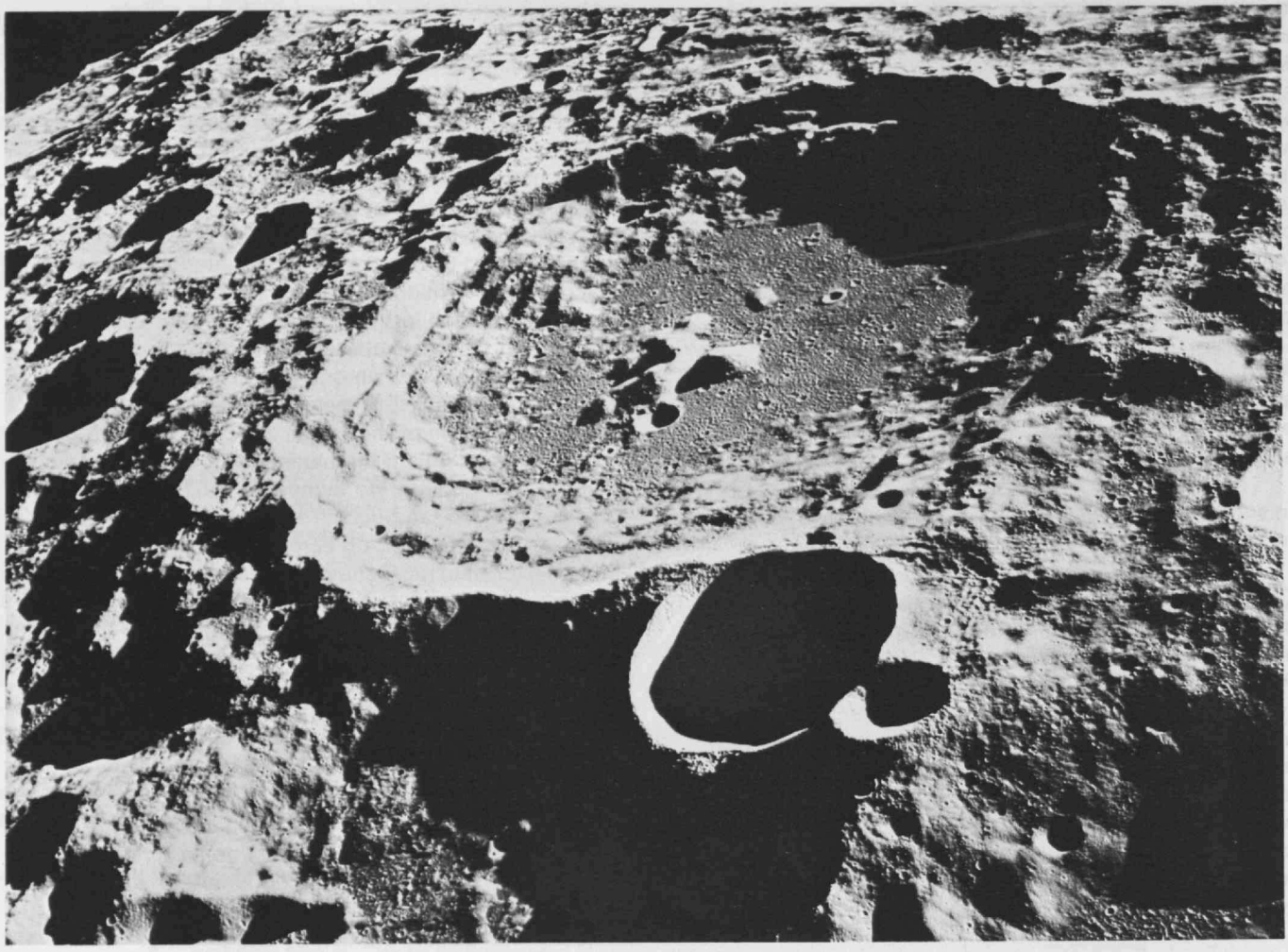
There is, unavoidably, a good deal of jealousy among writer-journalists toward television, the medium upon which they depend to witness such key events of a flight to the moon as the walk on the surface or the splashdown in the Pacific. A great many reporters, and many of their managers back in the home office, are convinced that more and more people are relying on television, that few people are reading much of the vast number of words they are writing and printing.

Certain it is that most people's view of an event such as Apollo 11 is shaped by what they saw of it on television, no matter how much better informed the best of the writer-journalists are than even the most enthusiastic television commentator, Walter Cronkite (who, quite frankly, makes a good many minor errors that nobody notices because he conveys a sense of personal involvement in space flights). But it is also certain that people are reading more, not less, about a particular event because they saw it on television; and they are reading with more care, because they feel, with some justice, that they know something on their own.

The more important point is that television not only is evanescent; it also is overwhelming. Too much happens, too fast. Television thrusts raw events at people, and they may wish to make more considered judgments. The immediacy of television must be strengthened by analysis and reflection. Only then, a day or a month later, can fleeting impressions be converted into a permanent mental image. For this—and for a significant proportion of the public—a writer is needed.

It is the writer who reminds the televiewer that Armstrong not only said, "One small step for a man, one giant leap for mankind," but also, "Isn't this fun?" and that Aldrin's first description of the moon was, "Magnificent desolation."

It is the writer who stays up late at night to watch the



$50,000 party that President Nixon threw the Apollo 11 astronauts after they emerged from their multi-million-dollar quarantine quarters in Houston on August 13, and to remind television-sated Easterners who hadn't stayed tuned that astronaut Neil Armstrong, in brief remarks near the end of the dinner around 2 a.m. E.D.T., recalled a sign he had seen during the ticker-tape parade that morning in New York. The sign read, "Through you, we touched the moon."

It is the writer who watches a nationally televised press conference with the astronauts on August 12, in which the astronauts said the moon seemed friendly despite its barrenness; who notes that they had apparently come close to being unable to land because they had nearly exhausted their fuel margins; and who puts two and two together and reports the next day that Armstrong was so determined to land that he might have disregarded a warning from Houston not to touch down.

Armstrong made it clear that fuel margins which seemed small were in fact large in view of the circumstances; and that, if he had lost contact with Houston, he would have pressed on to a landing if the trajectory was safe. Armstrong was quietly making clear that the astronaut in charge of a lunar landing vehicle, the apex of a huge technological pyramid, was not a supine passenger.

The Social Power of Exploration

The writer is the special extension of his readers' sensitivities. In the second row of the darkened auditorium in Houston on July 20, I was sitting next to Walter Sullivan, the Science Editor of the *New York Times.* He, like me, had opted to watch the moon-walk uninterrupted, in contrast to many other morning-paper reporters in an immense, echoing press room nearby. They were watching the event out of the corner of one eye in a glaringly-lit room, listening to the moon-talk over stereophonic headphones, and clacking away at typewriters.

As it happens, Sullivan is the author of the best general history of Antarctic exploration (*Quest for a Continent* New York: McGraw-Hill Book Co., 1957). We were both struck by how closely the barren ground of Tranquillity Base, viewed at the low sun angle of a lunar morning, resembled the blue and white snowscape at the South Pole during Antarctic summer.

Of course the resemblance was superficial, an accident of the medium—black and white television—by which most residents of the world's rich nations could bear witness to an event in a way that had never been possible before in the history of exploration. The astronauts themselves said that their surroundings in the Sea of Tranquillity, fancifully named by a 17th-century Italian astronomer, reminded them of a desert in the American southwest. As they spoke through the little two-way radios fitted into their back-pack life-support units, the astronauts were seeing the tawny colors of the moon's surface, of which they brought back ample evidence in

"Nowhere are the penalties of an estrangement from nature more apparent than in a place like the moon. . . . In such an extreme environment, many of the definitions of ordinary life must give way. . . . Man must be in sympathy with the surroundings—like Captain Nemo—or they will kill him." (Photo: N.A.S.A.)

many color photographs.

But if the colors were different, there were many other similarities between the moon, whose exploration has just begun, and Antarctica, whose exploration began only 70 years ago, just before the invention of the airplane.

Like the moon, Antarctica is a remote waste never inhabited by men until an age of scientific exploration. There is no trade with Antarctica and no military use for an expanse of 5.5 million square miles of ice at the southern extremity of the earth, dominating a hemisphere which is nearly all water and in which only 10 per cent of the world's people live. A rocket base makes as little sense in Antarctica as it does on the moon. If one is to have rocket bases at all, there are cheaper places closer to home to put them, places where the guardians of the rockets can live with their families, take correspondence courses and quickly replace the rocket's warheads when a better design comes along.

The circling of Antarctica by the ships of Captain Cook in the 1770's, the discovery of Antarctic coasts in the 1840's by Dumont d'Urville, James Clarke Ross and Charles Wilkes, and the attainment of the South Pole on foot by parties under Roald Amundsen and Robert Falcon Scott in 1911-12—all are landmarks in a living history of human exploration.

This history has reached another of its greatest climaxes with the first visit to the moon.

To those who ponder the values of such human achievements, let me simply proclaim that rigid intellectual forms, matching rigid social structures, cannot last in the face of a surprising new fact. It was possible to contest Copernicus' ideas of a group of planets revolving around the sun until Galileo's use of the telescope in studying the moon, and the moons of Jupiter, gave the theories of Copernicus unchallengeable empirical support. The work of Galileo, so intimately linked with the mountains of the moon, is a good candidate (among many) for the decisive event which launched the age culminating in a landing on the moon.

The immediate effect of such discoveries may be vanishingly small, even in the Apollo case when hundreds of millions watched it. A moon voyage may seem to count for no more than the fall of Icarus did to the painter Breughel, who depicted a very tiny splash in the midst of an immense landscape. Yet the splash occurred. The fact cannot be denied, and the exploration will continue—at however jerky a pace.

It is easy for an artist to mock the strivings of an Icarus. Explorers do not have an easy time giving words to their compulsion for searching out regions where nature shows its face in some extreme way, throwing light on the history and character of the planet on which we exist. Just why explorers, by their wanderings, should go on asking the question, "What is a Planet?" is not clear.

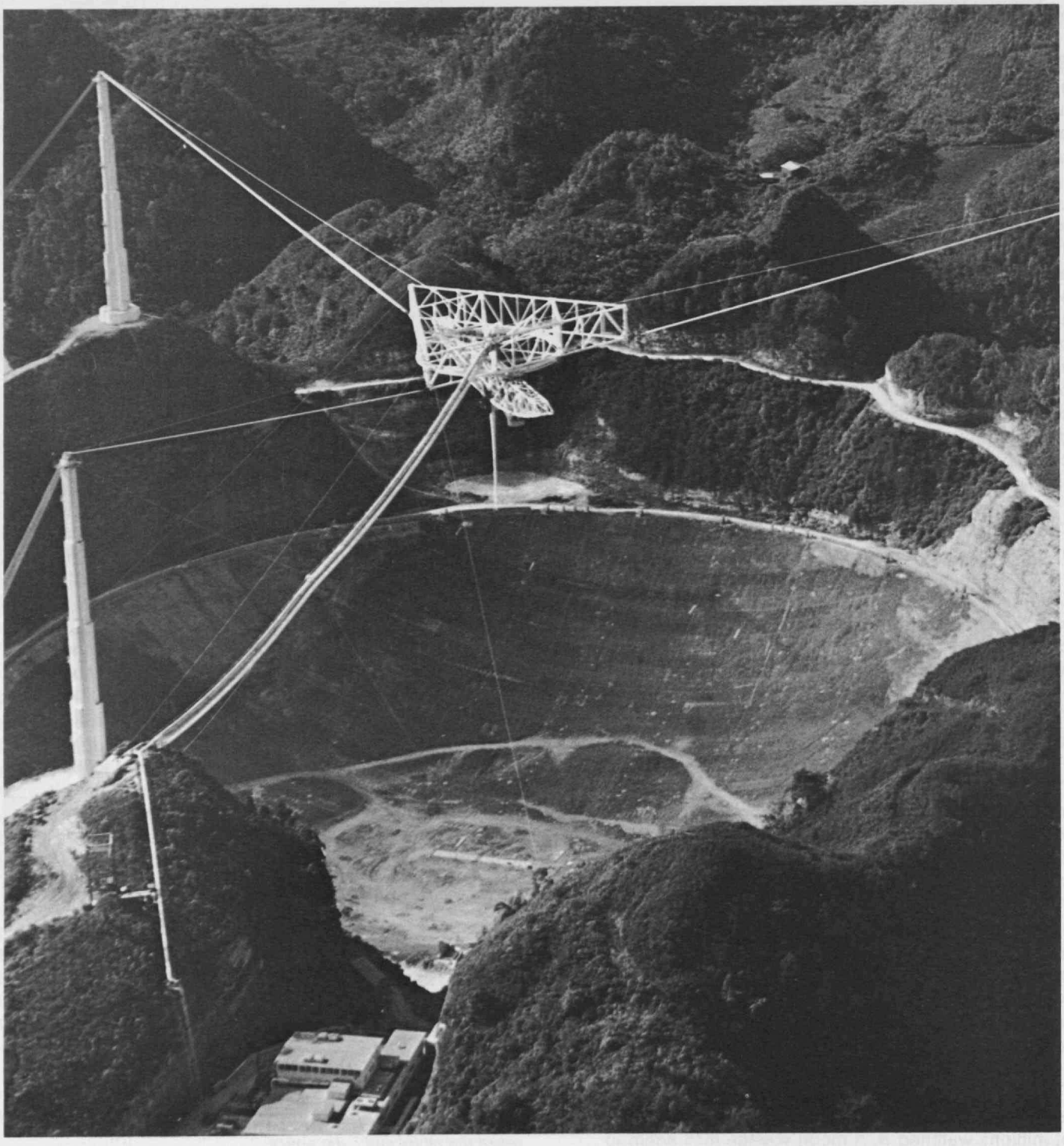
Antarctica, where few things exist except mosses, lichens, a few breeds of insects, seals, gulls and penguins, is one such region. The moon is another: lifeless, airless, waterless, lacking a magnetic field, of a different density from Earth, and now known to be covered with a layer of rather glassy dust. Neither Antarctica nor the moon have failed to produce their quota of surprises.

In such an extreme environment, many of the definitions of ordinary life must give way. Only an exceptional few can ever go to such a place. To live in a region of extremes means insulation from the natural environment; human contact with the surroundings must be restricted, remote. Yet, in order to design the protective equipment, someone must know enough about the surroundings to imagine their effect. Man must be in sympathy with the surroundings—like Captain Nemo—or they will kill him. Nowhere are the penalties of an estrangement from nature more apparent than in a place like the moon.

Such voyages to the end of man's experience and into the beginning of space are only the physical embodiment of the modern age of mental exploration—the age of science. In such an age, a science like astronomy, which has modest practical importance for navigators, can open men's eyes to the existence of another world. And in a land where minds and ships can roam beyond the reach of authority, tyrannical forms cannot endure.

Victor K. McElheny returned from his assignment in Britain as European Editor of Science *in 1967 to become Science Editor of the* Boston Globe *at least in part so as to have first-hand experience with what he has called man's "majestic" effort to reach the moon and outer space.*

The 1000-foot radar observatory operated by Cornell University in Puerto Rico is the largest and most powerful system in the world today. A special advisory panel has recently reported to the National Science Foundation, in urging minor improvements to extend its range and accuracy, that Arecibo "promises to be for many years the largest single-dish radio telescope available in the world." The author, who has used the Arecibo Observatory for much of the work reported in the accompanying article, says it represents "the kind of instrument which is necessary for planetary radar." (Photo: Cornell University)



The two inner planets, which have been difficult to observe using traditional optical methods, are yielding much surprising information to today's radar astronomers.

Thomas Gold
Director of the Center for Radiophysics and Space Research, Cornell University

The New Planetary Astronomy

Planetary astronomy has now achieved a new and very exciting understanding about the system of planets which provides the setting for our earth. From today's knowledge and technological capabilities we can fully expect answers to the major questions—how the planets were formed; what principal processes are now affecting them; whether our solar system is a common phenomenon arising from processes which we can imagine taking place in other parts of the universe as well, or whether it is unique.

We already understand many things which bear on these questions. We are now certain that the inner planets were formed from the accumulation of solid materials, and that they evolved in some system surrounding the sun. But the details of the process by which this happened is not at all clear.

The optical information about the planets that we have had in the past—pictures, spectra, measurements—is probably familiar to most readers. But radio and radar have given us a completely new way of investigating the planets, and most of our important new information has come through these media.

Powerful radio installations capable of transmitting pulses of great energy in very narrow beams, sensitive receivers able to detect the weak echo upon its return to earth, and computers to process these return signals —this is the equipment. Cornell University's Arecibo Observatory, a 1000-foot reflector set in the hills of Puerto Rico, is the largest and most powerful radar system, and it represents the kind of instrument which is necessary for planetary radar. In addition, two other observatories have made important contributions to radar astronomy—the M.I.T. Lincoln Laboratory, with its Haystack antenna, and the Goldstone antenna operated for N.A.S.A. by the Jet Propulsion Laboratory.

Chiefly with these three radar instruments, a whole new range of planetary information has been obtained in the last five years. Distances and detailed orbits are now known to accuracies far in excess of what was possible from optical information alone. We now know more accurately the periods of rotation of the planets, and we have new views of the nature of the planetary surfaces, about which radio can give us information totally unobtainable by other means. New understanding has resulted from all of this.

Planetary Distances and Orbits

One of our basic requirements is to know where the planets are and how they move, and the precision with which we know this has improved over the years. A distance in the inner part of the solar system—nine years ago uncertain by thousands of kilometers—is measured to, roughly speaking, two kilometers.

This improvement also appears in our knowledge of the planetary orbits. In 1964 the difference between our calculation of the position where Venus was expected to be and the planet's actual position, as measured by radar, was substantial—of the order of hundreds of kilometers. We have now achieved "residuals" of only a few kilometers—a difference that may not be an error at all, for if Venus has mountains comparable in height with Mount Everest, the distance to the surface of Venus must be variable by an amount considerably greater than the accuracy of our measurements.

Venus and Mercury are very difficult to observe optically—Venus because it is completely cloud-covered, the surface invisible, Mercury because it is so small and very close to the sun. For many years it was thought, for theoretical reasons, that both these planets ought to be rotating synchronously with their orbital motions—permanently locked with one face turned to the sun in the same way that the moon is permanently locked to the earth. This view resulted from the understanding that the tidal drag from the sun would have a large effect on these planets—since tidal torques are proportional to the inverse sixth power of the distance—and would bring the planet into a synchronous state of rotation no matter what the original spin may have been. (This theory did not depend on the existence of oceans on these planets, for tides are present in a solid body as well as in liquids; the sun exerts a couple on a planet, whatever its materials, and in the case of Venus and Mercury it was believed that this effect would lead eventually to synchronous rotation. This is, of course, what has taken place with the moon, and this is why the moon faces us the same way all the time.)

The radar method for measuring the rotation of a planet is simple. The signal that returns to us from the part of the planet nearest to us arrives first, and later the signals that have been reflected from further and further around the spherical body follow in succession. Each of these signals can be analyzed in turn for frequency

shifts caused by the Doppler effect, and on this basis the speed of rotation can be determined. For both Venus and Mercury, such studies yielded the most startling results.

In 1965, at Arecibo, Mercury was discovered to be rotating by no means in the synchronous way expected. We now know the rotation period very accurately; it is about 59 days (two-thirds of the orbital period). We also know that Mercury moves in its rather eccentric orbit in such a way that at perihelion—nearest approach to the sun—it faces the sun one way around this time and exactly the opposite way around the next. So it has two "poles," east and west, which alternately face the sun at the time of nearest approach.

Now that it is known by observation, this peculiar way of moving has been analyzed theoretically (first by Colombo and Shapiro). We can now construct a theory—belatedly, we have to admit—which makes it absolutely clear that this is an expected state of motion for Mercury, given the character of Mercury's orbit. The planet would be brought close to this rotation speed by tidal friction acting unevenly around the eccentric orbit, and any slight permanent deformation of the body would then allow it to get locked in this precise relationship.

The motion of Venus, optically unseen under its cloud cover, turns out to be very remarkable also. Venus turns retrograde—in the opposite sense to its motion around the sun; and it turns once around its axis in 243.1 days.

One may ask if precision in such a measurement is of consequence. The answer is that it is often of great interest to know things very precisely, even when, before you start, you know no particular reason for precision.

In the last few years the precision to which we know the rotation of Venus has improved enormously, and the value of this advance is far from trivial. Today's best figure of 243.09 ± .18 days is exactly the rate, within less than that margin of error, which makes Venus face the earth the same way around each time of the nearest approach of the two planets.

Now the earth, after all, is a very small body, the sun is enormous, and the distance is comparable. Why does Venus recognize the position of the earth in this particular way? The tidal influence that the sun exerts on Venus is 10,000 or 100,000 times greater than that of the earth. How has the earth come to dominate the rotation?

We have now determined some of the requirements that must be fulfilled for this state of motion to be set up. First, Venus must have started with a retrograde spin. Its rotation must have been slowed by tidal friction with the sun. But as Venus approached its present state of motion the earth must have exerted a significant influence. This would be possible only if Venus has a permanent deformation, for only with such a deformity to work on can the influence that the earth exerts on the planet compete with the influence of the sun, which acts only through the (non-permanent) tidal deformation. The tides raised by the sun might be a few feet high. When the rotation speed is right, the earth can get a grip on the planet through a permanent bulge which may be a few thousand feet high.

"Important evidence on the nature of its surface" has been provided by radar reflections from the planet Venus, according to Alan E. E. Rogers and Richard P. Ingalls of M.I.T.'s Lincoln Laboratory, writing in Science *this summer. By measuring the Doppler shift, time delay, and varying strength of radar signals returned from Venus, the M.I.T. group has identified repeatable characteristics in the radar reflections from parts of the planet, which they attribute to surface features, "most probably . . . changes in local roughness." The signal intensity map (left) shows the location of particular features on the Venusian surface, while the chart (right) translates these into "contours" delineating areas of low (white) to high (black) reflectivity. The chart also shows two large circular features (labeled 312-14 and 335-28) not seen in previous data. These features have the size and appearance of lunar maria, though this interpretation is highly speculative. The Lincoln Laboratory group concludes that the surface of Venus "is somewhat smoother on the average than the lunar surface." They made use of both Haystack and Westford radar antennas operated as a radar interferometer at 3.8 cm. wavelength.*

It has been calculated (by Goldreich and Peale) that, even so, Venus could never have settled in the state of motion which we now know it to have without an internal mechanism for dissipating tidal energy—two substantial masses flowing against each other. We believe that only a liquid core could provide the internal energy dissipation required to prevent Venus from overshooting the earth-locked rotation period and continuing to slow down.

Atmospheric tides like those on the earth are a further requirement, I believe, for Venus to have achieved its present state of motion. It takes these three effects working together—the permanent deformation of the planet, the liquid core, and a large atmospheric tide—to contrive to place Venus in the observed state of motion.

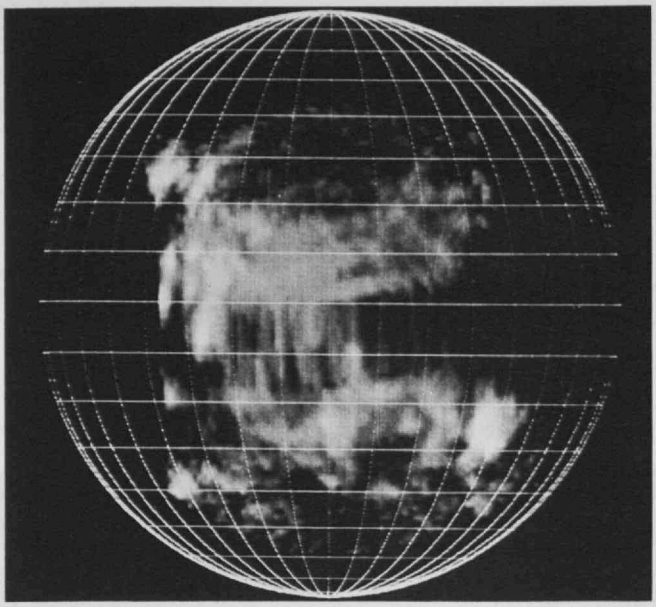
Thus, the radar information that we now have about the state of rotation of Venus has, through this complicated chain of theory, given us the information that Venus has a liquid core, perhaps like that of the earth. If anyone had asked, years ago, "How shall we ever discover whether Venus has a liquid core?" no one would have guessed that radar would be the way of doing it.

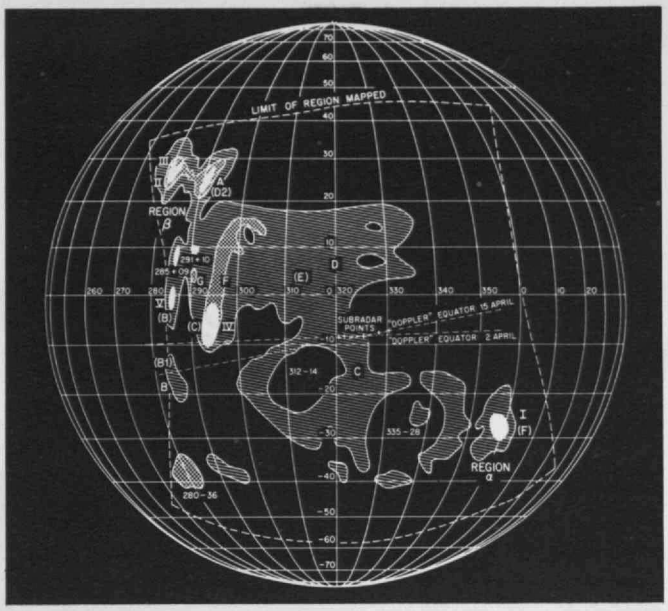
Mapping the Unseen Venusian Surface

One way in which the rotation of Venus became known so accurately was through recognizing surface features on the planet, again by radar.

Today's radar maps of the moon, constructed entirely from information on the range and doppler shift of each bit of radar signal that is returned, are comparable in definition to photographs made from the earth, though in detail the kind of information that is given is somewhat different.

Radar maps of Venus cannot yet be made nearly so





well. But some permanent features on the face of Venus can be recognized time and again, and their motion can be carefully charted. This is the beginning of a map-making process. With the improvement that we can expect to take place in large radar telescopes, we can safely promise radar maps of Venus with the kind of definition now obtained in moon maps—a resolution of about 5 kilometers. This is a far better precision than we achieve in optically mapping Mars from earth, in spite of the clearness of the Martian air. Soon, then, it will be possible to see whether there are chains of mountains, ocean basins, and continental blocks on the surface of Venus. It will even be possible to see whether there is erosion—and of what form. If you looked at the earth from Venus with similar resolution, you would easily recognize all the major features of the terrestrial topography, including erosion by rivers.

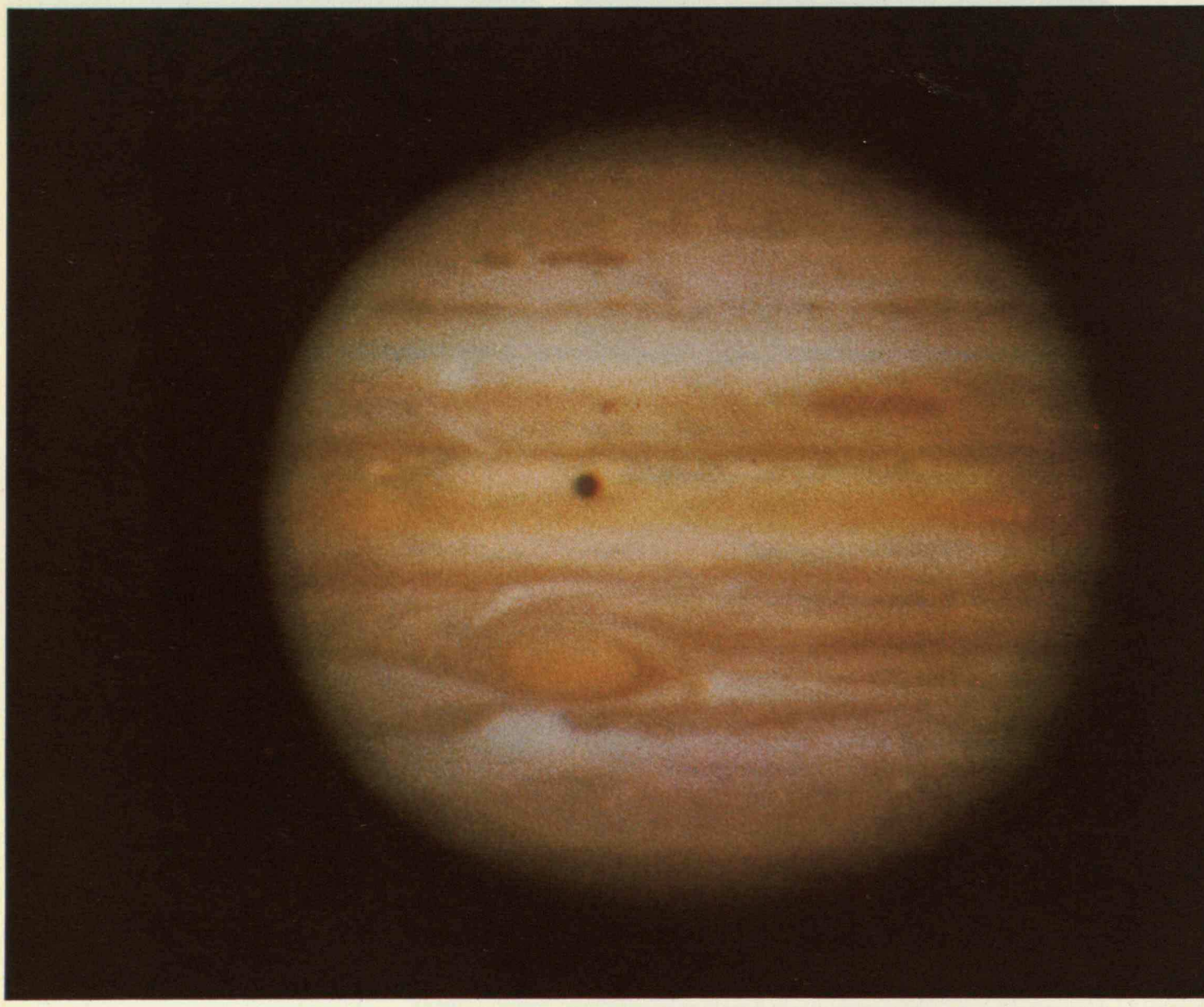
We believe that Venus has an opaque atmosphere reaching 100 earth-atmospheres pressure and a temperature of some 700° K. We know of no other way of surveying its surface, and radar offers us our only opportunity of obtaining a detailed map.

We cannot be sure yet in what way such a map will be important to us. But if we can determine in detail the differences between the planets, we will have an important indication of what is general and what is specific. We may understand whether the same processes gave rise to the totally different atmospheres of Mars, Venus, and the earth; and why there is water on the earth in great abundance but apparently very little on Mars and none (or very little) on Venus.

In the end, how much will it be worth to know what were the processes that shaped the planets, and led to the particular properties of our earth—the building of the continents, the ocean basins, the spreading of the sea floor, the atmosphere, and the large abundance of water? Understanding these things will be a major achievement in terms of scientific information, to satisfy our curiosity. But in the long run, this information will surely also help us to exploit better what our earth has to offer. A general understanding of the planets will be of great practical value to mankind.

Thomas Gold is Professor of Astronomy and of Electrical Engineering, Head of the Department of Astronomy, and Director of the Center for Radiophysics and Space Research at Cornell University. After completing his education and an early career in physics teaching and research at Trinity College, Cambridge, England, he came to the U.S. in 1958 to join the Harvard University faculty; he has been at Cornell since 1959.

The most striking single visual feature of Jupiter—a massive planet which accounts for 71 per cent of the mass of the sun's entire planetary system, is the Great Red Spot. It is an elliptical region larger in area than all of Earth, but its composition is unknown, its existence an enigma. (Photo: Lunar and Planetary Laboratory of the University of Arizona, courtesy of Sky and Telescope)



A theoretical study of 500 compounds which could form from a mixture of elements such as is present in the sun gives a model of Jupiter which agrees remarkably with observations.

John S. Lewis
Assistant Professor of Chemistry and of Geology, M.I.T.

The Chemistry of the Largest Planet

Our planetary system is dominated by four giant planets: Jupiter, Saturn, Uranus, Neptune. These four planets contribute 99.5 per cent of the mass of planetary system, Jupiter alone accounting for 71 per cent.

But Jupiter is remarkable for reasons other than sheer mass. Three centuries of telescopic observations of the cloud-covered face of Jupiter have served only to increase our astonishment at the processes occurring there. The cloud bands which encircle the planet parallel to the equator are known to have different velocities: rotational periods deduced from cloud features at different latitudes may differ by several minutes (they are in the region of 10 hours). The half of the surface area nearest the poles is covered by a featureless greyish cloud cover. So bright are the clouds in general that the overall reflectivity of the planet is about the same as that of a sheet of white glazed paper.

The most striking single visual feature of the planet is the Great Red Spot (G.R.S.), an elliptical region larger in area than all of Earth. The G.R.S. varies irregularly in color from grey through pink to brick red. In addition, the G.R.S. does not have a fixed period of rotation around the planet's axis, but it seems to float freely in longitude. Even in a coordinate system chosen to minimize its motion, the spot is seen to have wandered, more or less randomly, during the time it has been observed, *three times* around the planet!

Frequently, small bright or dark spots appear on the planet, generally within 45° of the equator, and they may remain visible for weeks or months. Spots which appear near the latitude of the G.R.S. usually have a slightly different rotational velocity, and hence may pass by the G.R.S. occasionally. Those that do, accelerate very markedly and dash by the G.R.S.—except for a few dark spots which have been observed to loop *around* the G.R.S. for up to 1½ laps (taking about 20 days) before fading from view.

In the past decade, radio astronomers have discovered intense radio-frequency emission from the vicinity of Jupiter, and it has been well established that the dominant sources of this radiation are "Van Allen-like" belts of particles trapped in Jupiter's magnetic field. A substantial dipole field, aligned rather closely with the axis of rotation, seems to be indicated though this is not certain or explained.

Decametric radiation, however, appears to emanate from the disc of the planet itself, and is very sporadic in nature. This radiation is modulated by the position of Io, the innermost of the four large satellites discovered by Galileo. This effect may indicate that Io has a magnetic field large enough to interact significantly with that of Jupiter, or alternatively only that Io acts as a conducting sphere. Jupiter's other 11 satellites exert no detectable influence on the radio emission.

The Spectroscopic Picture

Gerard Kuiper long ago established the presence of methane (CH_4) and ammonia (NH_3) in the atmosphere of Jupiter, and Herzberg was able to identify another feature in one of Kuiper's spectra as a pressure-induced transition dipole of the hydrogen molecule, H_2. It has now been known for over 15 years that H_2, CH_4, and NH_3 are present in the atmosphere of Jupiter above the cloudtops, and Kuiper long ago made a good case for the identification of the clouds as solid ammonia crystals.

But one of the most interesting facts about Jupiter and Saturn is their extremely low densities, only 1.33 g./cu. cm. for Jupiter and 0.71 g./cu. cm. for Saturn. Because of the immensely high pressures to be expected in the interiors of these planets, it is difficult to think of a material which will maintain such low densities.

The lowest-density solids are hydrogen and helium, and we might start by inquiring what would be the density of objects the size of Jupiter and Saturn composed of hydrogen and helium. P. J. E. Peebles, a theoretical physicist at Princeton University, has calculated that Jupiter would have to be at least 76 per cent (weight) hydrogen (more than that if heavy elements are included) to have the observed density. This is essentially the same as the fraction of hydrogen present in the Sun, which however contains other elements than hydrogen and helium (*see table*).

Peebles found that, using the theoretical equations of state for H_2, He and metallic hydrogen at absolute zero, Jupiter- and Saturn-sized planets of solar composition should be *denser* than these planets are actually observed to be. It seems that Jupiter and Saturn must either contain proportionately more H_2 than the sun, or else have internal temperatures very considerably higher than 0° K.

Of these alternatives, the first seems very unlikely, in view of present models for the origin of planets. The high-temperature model seems *a priori* more reasonable. Fortunately, Peebles could use a second line of evidence to try to choose between the alternatives: compositional models of the planets, taking into account their observed rotation rates, can be used to predict their rotational moments of inertia. These could then be compared directly with the moments of inertia deduced from their oblateness (which can be estimated from gravitational effects on the orbits of Jupiter's and Saturn's inner satellites). Peebles found that for Saturn, only an "adiabatic equilibrium" model with high internal temperatures and a deep convective atmosphere survived this test (In an adiabatic atmosphere, pressure and temperature are related in such a way that a mass of gas moving up or down immediately assumes the pressure and temperature of its surroundings). Such a model also worked very well for Jupiter. The temperature at the center of Jupiter has to be about 10,000°K.

The structural evidence alone, therefore, suggests not only a unique physical model (adiabatic equilibrium) but also a unique chemical model (solar composition) for both Jupiter and Saturn. In addition, we have some other, very different, evidence bearing on the physical structure and chemical composition.

First, F. J. Low's measurements of the heat flux emitted from Jupiter at infrared wavelengths show that the effective temperature of the planet is about 140° K. This is much higher than the equilibrium temperature that Jupiter would attain under the influence of sunlight alone (about 103° K), and suggests that Jupiter emits several times as much energy as it receives from the sun.

Also, observations of Jupiter's radio intensity at wavelengths longer than 1 cm. show a marked increase of apparent temperature with wavelength. Using the one-mile radio interferometer at Cambridge University to distinguish the thermal radiation of the disk of Jupiter from the radio emission of the Jovian radiation belts, N.J.B.A. Branson finds an apparent temperature of about 250° K at wavelength 21 cm.; Glenn Berge derives a temperature of nearly 300° from the same data.

This effect is almost certainly due to the fact that longer wavelengths penetrate the atmosphere further. As we increase the wavelength we thus see progressively deeper levels in the atmosphere of Jupiter, right on out to 21 cm.

Both of these sets of observations support the concept of a hot, deep, and turbulent atmosphere. Hubbard, in fact, has recently shown that the entire body of the planet must be in a convective state in order to deliver this much heat to the top of the atmosphere.

Recently, Jack Greenspan and Tobias Owen of the Illinois Institute of Technology have summarized the available spectroscopic data on the abundances of hydrogen, methane and ammonia in the upper atmosphere of Jupiter and have concluded that the carbon-to-hydrogen ratio on Jupiter is identical with that found for the sun. Ammonia vapor is less abundant, spectroscopically, than would be expected if the same were true of the nitrogen-to-hydrogen ratio, but this is explained if the observed cloud deck is composed of solid or liquid NH_3 (which give no spectra), with NH_3 vapor nearly completely frozen out above the cloud tops.

Greenspan and Owen discussed a simplified chemical model for the atmosphere near the clouds. They noted one shortcoming—there was no mechanism to remove hydrogen sulfide (H_2S) from the upper atmosphere, where it has not been observed, although sulfur exists in the sun. They concluded that the observational failure to detect H_2S was the only point of discordance between present observations and a solar-composition model for Jupiter.

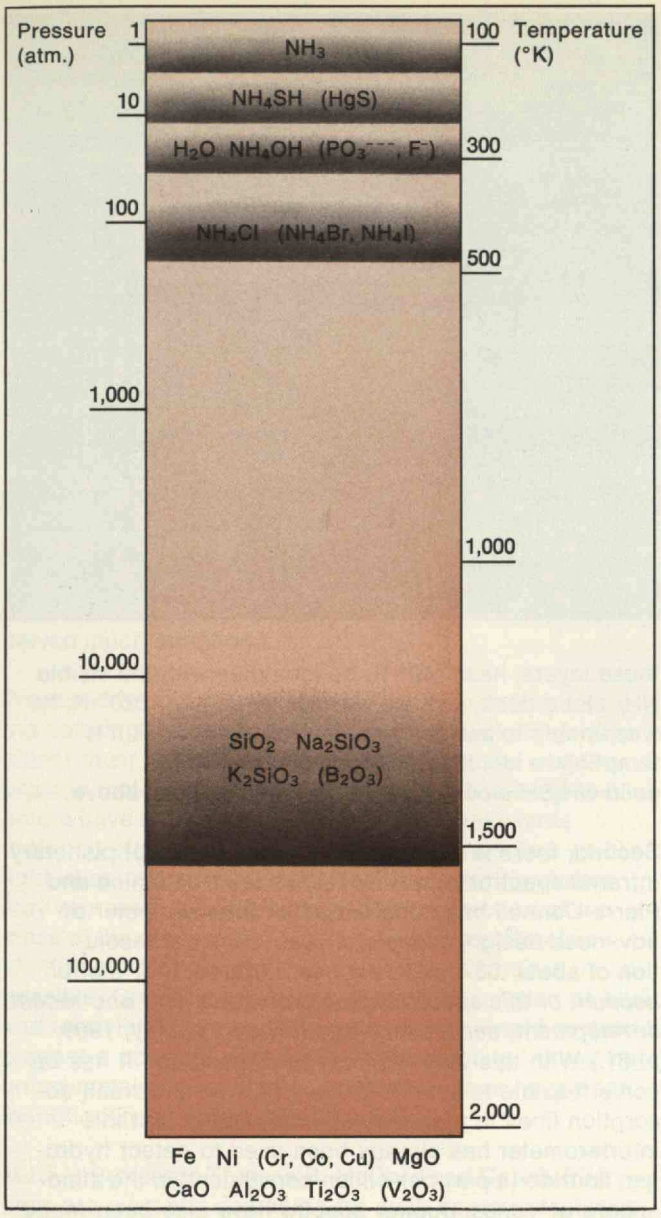
The Chemist Gets to Work

To a chemist, these conclusions concerning the structure and composition of Jupiter represent a tremendous amount of data: the "solar composition" condition permits him to transfer directly to Jupiter his knowledge of the abundances of some 90 elements in the Sun and in meteorites, and the adiabatic equilibrium condition permits him to calculate directly the atmospheric temperature and pressure as functions of altitude.

He can then determine, at each level, what chemical species will be present (and in particular, the compounds that will form), what solids and liquids might be stable at great depths within the planet, what materials might condense out of the atmosphere at higher levels to form clouds, and what spectroscopically detectable gases should be present above the topmost clouds. These results will be of central importance in planning earth-based and space-probe investigations of Jupiter and Saturn.

The precise computational strategy to adopt in such an approach is largely a matter of taste. I have chosen to begin the calculations at the greatest depth (and thus highest temperature) at which chemical equilibrium calculations have any chance of success, and to find in a rather qualitative manner what elements will be removed from the atmosphere by condensation at or below this level. These elements can then be omitted altogether from succeeding calculations at higher levels.

The temperature and pressure at the "starting level" (called by Peebles the "surface" of the planet) are



A thermodynamic model of Jupiter's atmosphere provides a framework for chemical reasoning as to what substances should condense out of the gas at different levels. Below the 2000° K. level (i.e., at higher temperatures than this) the condensed materials that can exist include the metals iron, nickel, chromium, cobalt, copper, and the refractory oxides of magnesium, calcium, aluminium, titanium and vanadium. Of the compounds that remain gaseous at this level, a silica-based group condenses into a diffuse cloud at about 1500° K. (together with boron oxide). The halogens—chlorine, bromine, iodine, fluorine—are gaseous to much lower temperatures; three of them form a cloud in combination with ammonia at 475° K. The next cloud layer is like earthly water clouds, but with dissolved ammonia, and phosphate and fluoride ions. At this level, a number of elements are still gaseous, plus methane, ammonia and hydrogen sulfide; at 225° K. the latter two combine and condense out as ammonium hydrosulfide, together with the mercury sulfide, cinnabar. The topmost, and coldest, cloud is of solid ammonia; hydrogen, helium, methane and neon remain gaseous at the fringes of the atmosphere.

2000° K and 2×10^5 atm. (Peebles means by "surface" solely that the ideal-gas equation of state of hydrogen (H_2) intersects the theoretical equation of state of solid H_2 at that level: there is no need to suppose that a real gas-solid boundary exists there or elsewhere). The abundances of 40 important elements are specified by the solar composition data, and we can use them to calculate the abundances of over 500 chemical compounds at the specified temperature and pressure.

The results for the 2000° K level are as follows: First, silicon is found to exist mainly in gaseous compounds. Silane (SiH_4), silicon monoxide (SiO), and silicon monosulfide (SiS), would be dominant, while quartz (SiO_2) and common silicates would be absent. There can thus be no similarity between the geochemistry of minerals on Jupiter and those on Earth.

Second, the iron-group metals are found to be condensed out of the atmosphere at this level. An iron-nickel core containing some cobalt, chromium, copper, etc., is therefore plausible (but not essential—these metals may be dispersed in hydrogen and helium at very great depths).

Third, a group of very refractory metal oxides can survive volatilization. Oxides of magnesium (MgO), calcium (CaO), aluminum (Al_2O_3), titanium (Ti_2O_3) and vanadium (V_2O_3) could be present in a solid or liquid solution. Only a trace of SiO_2 could be dissolved in this solution. Thus an "outer core" of oxide minerals is also plausible for Jupiter, but we cannot be certain that it exists.

All the rest of the 40 elements considered are still wholly present in the atmosphere at the 2000° level.

The next atmospheric feature of note is a deep-lying and extremely diffuse cloud layer, centered near the 1500° level, composed mainly of silica (SiO_2). The upper portions of this layer will contain sodium and potassium silicates, and a minor amount of boron oxide (B_2O_3) will be present. Possibly the closest terrestrial analogue of the cloud composition (though not a very exact one) would be Pyrex. Silicon, sodium, potassium, and boron will be essentially absent above the 1000° level.

After a very extensive "clear" region in which no appreciable cloud formation should occur, there should be an ammonium halide cloud layer near the 475° level. Ammonium chloride will be the dominant compound, accompanied by minor traces of the bromide and iodide. Ammonium fluoride will not, however, be present: it is much more volatile than the other ammonium halides.

Minor amounts of the rare elements germanium, selenium, and tellurium will also precipitate out in this region.

Next in order, starting at the 300° level, is the most massive cloud layer of all: liquid water. As a result of the very great solubility of ammonia in water and the fall in freezing point that the addition of ammonia induces, ice will be a much less important cloud material. The chemistry of the water clouds is not trivial—ammonia (more than 1 mole/liter), the fluoride ion, and ammonium salts of phosphorous acid (H_3PO_3) should be present in solution. At high altitudes, the water clouds decrease markedly in mass, but the ammonia concentration therein increases to about 20 moles/liter. A thin layer of the solid hydrates of ammonia, $NH_3.H_2O$ and $2NH_3.H_2O$, will top off the aqueous clouds.

The elements surviving above the water clouds are hydrogen, carbon, nitrogen, sulfur, mercury and the inert

The table shows the relative abundances of elements in the sun. Theoretical calculations show that if Jupiter were cold and composed only of hydrogen and helium, the proportion of hydrogen in Jupiter would be essentially the same as that shown for the sun (right).

Element	Abundance (numbers of atoms relative to Si = 10^6)
Hydrogen	28×10^9
Helium	2×10^9
Oxygen	17×10^6
Nitrogen	3×10^6
Neon	2×10^6
Silicon	1×10^6
Magnesium	850×10^3
Sulphur	460×10^3
Argon	150×10^3
Iron	90×10^3
Aluminum	70×10^3
Calcium	60×10^3
Chlorine	56×10^3
Sodium	43×10^3
Fluorine	32×10^3
Nickel	28×10^3
All others combined	26×10^3

gases helium, neon, argon, krypton and xenon. The only chemical compounds present in the gas would be methane, ammonia and, apparently, hydrogen sulfide.

At the 225° level we encounter yet another cloud layer: the compound ammonium hydrosulfide (NH_4SH) freezes out. This completely removes hydrogen sulfide (H_2S) from the upper atmosphere—which solves the problem of its absence encountered by Greenspar and Owen. Cinnabar (HgS) coprecipitates with NH_4SH in very small amounts. The yellow-orange solid ammonium sulfide, $(NH_4)_2S$, may also be present in significant amounts.

Finally, starting at the 165° level, there is the well-established cloud layer composed of solid ammonia. The atmosphere high above the NH_3 clouds contains only H_2, He, CH_4, and Ne in significant amounts. Traces of H_2O and H_2S will be present, but they will be 100 million times less abundant than CH_4, and hence completely unobservable with present spectroscopic techniques.

Viewing the atmosphere from above, we will expect to see to some depth into the NH_3 clouds, and thus an observable amount of NH_3 vapor is likely to be in our line of sight: knowing the vapor pressure equation of NH_3 we can in fact calculate this quantity, and it is rewarding to find that the calculated amount is in agreement with observation.

The Theory Meets the Facts

Thus, after considering 500 compounds of 40 elements, we are left with only three detectable gases above the clouds—and these three are precisely those actually observed. We therefore must conclude that even in this very rigorous test, no discrepancy can be found between our simple model of the planet and our present observational data.

But, given this very detailed model for the clouds and atmosphere of Jupiter, what are the prospects for early observational verification or refutation of these predictions?

The most immediate source of data would seem to be earth-based observations. F. C. Gillett of the University of California at San Diego has in fact just reported on an investigation of the thermal emission from Jupiter between the wavelengths of 5 and 15 microns: he finds evidence for two discrete cloud layers. The cooler of these layers, near 140° K, he identifies with the visible NH_3 cloud deck, and the warmer layer, near 220° K, he was unable to assign to any plausible material. It is tempting to identify this second layer with the solid NH_4SH cloud deck (at 225° K) proposed above.

Second, there is the rapidly developing field of planetary infrared spectroscopy. The French team of Janine and Pierre Connes has constructed an interferometer of advanced design, capable of a wavenumber resolution of about .08/cm. in the near infrared. (*For a brief account of this spectroscopic technique, and one recent development, see* Technology Review *for May, 1969, p. 61.*) With this very high spectral resolution it has become feasible to search for very narrow and weak absorption lines in planetary spectra, and in fact this interferometer has already been used to detect hydrogen flouride (a part-per-billion constituent) in the atmosphere of Venus. Jupiter spectra have also been made using this instrument, but none have yet been published. In addition, the Connes have under development an even more sensitive interferometer which will be in use shortly. Several groups of astronomers in the United States have been converted to interferometry, and the next few years should see a great upsurge in the published work in these areas.

The results of my equilibrium calculations, however, suggest that even with very large improvements in the sensitivity of Earth-based infrared spectroscopy, it will not be possible to detect any additional constituents of the atmosphere of Jupiter and Saturn. The possibility of detecting disequilibrium species produced by photolysis or other energetic processes cannot be wholly discounted, but it is very difficult to estimate the steady-state abundances of such compounds in the upper atmosphere.

One reasonable proposal would be to carry a high-resolution spectrometer on a Jupiter flyby probe. From close to the planet it would be possible to get very high spatial resolution, and spectra of the Great Red Spot, various bands and belts, and the polar regions, would be easy to

obtain. Perhaps it would even prove possible to peek between the solid ammonia clouds and gather some data about the atmospheric composition immediately below.

Because of the presence of large amounts of NH_3, H_2O and H_2S the atmosphere is presumably opaque to microwaves not far below the water clouds. It therefore seems almost certain that no radar reflections will be obtainable from the planet's "surface." Non-thermal microwave emissions from electrical discharges in the water cloud deck (which presumably generates lightning storms just as our own does) may complicate the interpretation of even close-up measurements. Long-baseline radio interferometry holds the promise of permitting detection and resolution of thermal radiation from Jupiter at wavelengths beyond 21 cm., but it is not clear that ground-based radio astronomy will otherwise do more than fill in the gaps in our present data from 4 to 9 and from 12 to 20 cm. (The reason for these gaps is simply that, as yet, only certain narrow wavebands have received much attention.)

Proposed investigations of the chemical composition of the coloring matter in the G.R.S. and elsewhere on the planet must face the unfortunate fact that the complex organic molecules usually held responsible for these colors have extremely large extinction coefficients (coloring effect per molecule) for ultraviolet and visible light absorption: This means that the coloring matter may represent a completely negligible fraction of the mass of the clouds. Chemical or mass spectrometric identification of the chromophores may therefore be impossible. One might suppose that the absorption of blue and ultraviolet light by these compounds would in itself present a possible method of "fingerprinting" them, but unfortunately no resolvable absorption lines have been identified in the spectrum of the G.R.S.

M.I.T.'s Professor Thomas B. McCord and Carl B. Pilcher are currently searching for such spectral features on Jupiter, since the entire equatorial region of the planet has recently turned from pale gray to a striking brownish yellow. Ronald G. Prinn in my laboratory is now engaged in an experimental and theoretical study of possible colored compounds for comparison with the planetary observations.

Space-probe Experiments

The structure of Jupiter's magnetosphere could be examined in detail by a flyby probe or, preferably, an orbiter. However, a space probe fired on a fast trajectory (less than two years in flight) would arrive at Jupiter with a substantial velocity relative to the planet. A large mass of propellant must be expended to place this probe in orbit, and this in turn requires a great sacrifice in scientific payload weight. It appears simpler to hit Jupiter with an entry probe than to orbit the planet. Detailed space- and time-dependent studies of the magnetosphere and atmosphere by an orbiter will probably be best postponed until at least one entry probe has paved the way.

N.A.S.A. is currently studying small Jupiter flyby probes for launch in 1972 and 1973, and several missions are under study for the "grand tour" period in and around 1977. Among the latter are proposals for a single large probe to fly by Jupiter, Saturn, Uranus, and Neptune. There are variants to this plan which would pass by these planets and Pluto as well, using two different probe vehicles. There is discussion also concerning a possible landing probe, to be carried as a subsidiary payload by the flyby bus, which might be landed in Jupiter's atmosphere as early as 1974.

Aside from temperature and pressure sensors, the most important single experiment for such a probe would be a compact mass spectrometer of large dynamic range, capable of measuring the composition of the atmosphere at several specific altitudes during its fall. A mass spectrometer capable of covering the atomic-mass-unit range 2 to 40 could measure the abundances of H_2, He, CH_4, NH_3, H_2O, Ne, H_2S, HCl, and Ar and the isotopic composition of H, He, C, N, O, Ne, S, Cl, and Ar as well. These data are of central importance in constructing models of the early solar system and the origins of the planets.

In order to assure an optimum scientific return on the experiment the probe should be capable of withstanding a temperature of about 500° K. at a pressure of about 300 atm. This would permit the probe to penetrate to the "clear" region below the ammonium halide clouds. A probe capable of withstanding 100 atm. pressure at a temperature of only 350° K. would return data of great importance, and should perhaps be a minimum objective for an entry probe. Note that, except for the extreme temperature experienced by the deeper probe, no conditions are encountered which are grossly beyond the experience of oceanographers.

Suggested Readings

"The Outer Solar System: A Program for Exploration," report of a study by the Space Science Board, June, 1969. Available from the Space Science Board, 2101 Constitution Ave., Washington, D.C., 20418.

Proceedings of the A.A.A.S. Symposium, "Jupiter and the Outer Planets," Dallas, December 29-30, 1968. *Icarus*, Volume 10, Number 3, May, 1969.

John S. Lewis studied chemistry at Princeton University (B.S., 1962), inorganic chemistry at Dartmouth College (M.S., 1964), and geochemistry at the University of California, San Diego (Ph.D., 1968). His principal research interests concern the geochemistry, isotopic chemistry, and thermodynamics of the volatile elements, particularly with respect to the composition, structure and origin of planetary atmospheres, the composition and origin of meteorites, and the early history of the solar system.

"The Apollo 11 mission . . . has demonstrated our mastery of a superb technology. Within another year the scientific results should lead, for the first time, to a unified theory of the moon and a greatly enhanced understanding of the earth and the solar system."

The moon is close to the earth, highly visible, and even prior to the Apollo missions it had yielded a wealth of scientific data. Yet its measured properties remained inexplicable by any single model of origin and evolution. Now, after man's first lunar landing, they still do.

Ursula B. Marvin
Smithsonian Astrophysical Observatory

Our Unique Satellite

On July 20th, 1969, Neil Armstrong and Edwin Aldrin stepped out upon one of the most enigmatic bodies in the solar system. The moon has long been a puzzle to scientists, in respect to its size, shape, density, and orbit. New data, collected by unmanned satellites, provided fresh surprises: the near absence of dark, lowland areas on the moon's far side, the presence of enormous mass concentrations (mascons) in the ringed maria of the near side, and the analyses of lunar rock, made by Surveyor craft, which showed a small but significant enrichment in titanium as well as other differences between lunar rock and any common terrestrial rock.

The scientific experiments and rock collections of the Apollo 11 landing are yielding spectacular results, including the ancient age (by potassium-argon ratio measurements) of about 3.5 billion years for rocks from Mare Tranquilitatis, the unexpectedly high densities of 3.4 to 3.5 g./cc. for some of these rocks, their unique chemical composition, and the absence of any trace of water in the lunar rocks and soils. At the same time these results are already beginning—as noted by Professor Eugene Shoemaker of California Institute of Technology—"to raise ten times as many good questions as they are likely to answer." A review of the properties of the moon as we now know them will illustrate both the depths of the scientific dilemma regarding its nature and origin and the type of investigations that will be of primary importance on the future Apollo missions.

The Unique Earth-Moon System

The moon has a diameter of 3,476 km., which is about one quarter that of the earth. No other satellite approaches so closely the size of its primary planet. The 12 moons of Jupiter include two about the size of our moon and two others as large as the planet Mercury. Still, the diameters of all 12 moons added together equal only about one-eighth of the vast equatorial diameter of Jupiter (1,418,240 km.). The mass of the moon is about 1/80th that of the earth, and this ratio is by far the highest in the solar system; relative to their planets, the masses of other moons are measured in thousandths. The earth and moon are therefore often described as a binary system behaving as a unit.

From the distance of the sun this unit would appear as one very lopsided body—a pair of mis-matched dumbbells rotating about a center of gravity that lies deep within the mantle of the earth, about 4,670 km. from its geometrical center. This center of gravity sweeps smoothly around the sun in an elliptical orbit while the bulk of the earth and the moon wobble about it, inward and outward along its path.

The moon orbits the earth every 27.33 days in a plane tilted 5°9′ to the ecliptic, and with the same side always facing the earth. The tilt of the orbit is an unsolved problem. The synchronous orbit is apparently caused by the tidal pull of the earth on the moon's asymmetrical gravity field, which has a pronounced bulge on the earth-facing side.

A less well known uniqueness lies in the dynamic relationship between earth and moon: the moon is the only satellite in the solar system possessing greater orbital angular momentum than the rotational angular momentum of its planet. At present the moon is retreating from the earth in a wider and wider orbit; meanwhile, the earth's rotation is slowing down, making our days grow longer (by 1.8 milliseconds per century). This reciprocal action results from the frictional drag of the tides on shelving ocean floors, braking the earth's rotation and transferring angular momentum to the moon (the tides, forced forward by the turning earth, exert their own gravitational effect). Independent evidence that the retreat of the moon has continued at about the same rate for at least 400 million years is provided by the diurnal growth rings on Devonian corals, which show that the earth then rotated some 400 times per solar year.

Extrapolating backwards, one finds the moon only 2.89 earth radii away in the late Precambrian, 1,500±200 million years ago. Is such extrapolation valid? In any case, what happened at that time? Where was the moon earlier? Was the moon captured, was it torn from the body of the earth, or has it always been nearby? Speculations on the origin of the moon have proved largely futile and will remain so until we obtain additional hard data on the moon's chemistry and its thermal history. One of the first major issues that may be settled by the Apollo missions is the controversy over the extent of volcanism on the moon.

Thermal History: Hot or Cold?

Numerous investigators have calculated that if a body as

The chart shows an oxide composition of lunar mare material calculated from Surveyor 5 results and samples returned by Apollo 11.

Oxide	Weight per cent	
	Apollo 11	Surveyor 5
Silicon dioxide (SiO_2)	40	46.4
Aluminum oxide (Al_2O_3)	10	14.4
Titanium dioxide (TiO_2)	11	7.6
Iron oxide (FeO)	19	12.1
Magnesium oxide (MgO)	8.5	4.4
Calcium oxide (CaO)	10	14.5
Sodium oxide (Na_2O)	0.65	0.6
Potassium oxide (K_2O)	0.22	—
Magnesium oxide (MnO)	0.35	—
Chromium oxide (Cr_2O_3)	0.67	—
Zirconium oxide (ZrO_2)	0.19	—

large as the moon resembled either the earth or chondritic meteorites in composition, it should have undergone substantial heating from the decay of radioactive isotopes of potassium, uranium and thorium. Once heated, the interior should cool at a very slow rate, on a time scale similar to the age of the solar system.

The lunar rocks analysed in the Lunar Receiving Laboratory in Houston proved to have strikingly low ratios of potassium to uranium in comparison to meteorites and terrestrial rocks of generally similar bulk composition. Nevertheless, they contain sufficient potassium, uranium, and thorium to produce a thermally active moon if their composition represents that of the entire body. At the same time the tentative age measured by potassium-argon ratio on these rocks indicates that they have never been heated above about 250° C during the past 3.5 billion years while radiogenic argon-40 has been accumulating in their crystal lattices. Thus, if the igneous rocks of Mare Tranquilitatis and presumably of other maria are volcanic eruptives from a hot interior, they testify to a very early phase of thermal activity followed by 3.5 aeons (1 aeon = 10^9 years) at much lower temperatures.

This ancient age inferred for the lunar maria challenges many carefully conceived hypotheses of the origin of the moon itself and of lunar topography. For the maria are clearly younger than most of the surrounding highlands. The maria are dark, smooth plains that appear to flood the "seaward" margins of adjacent craters and to have relatively few craters pitting their surfaces. If these vast features are 3.5 aeons old, then the highlands must include regions that date back toward 4.5 aeons and the beginning of the solar system. Highland samples will be of great interest because, although the majority of meteorites appear to have crystallized about 4.5 aeons ago, the oldest known rocks in the earth's crust, with its complicated history of chemical recycling, are only 3.5 aeons old.

It is still too early to accept or reject the arguments of those scientists who, for many years, have believed that thermal activity has been important and that lunar topography is governed mainly by internal forces. In their view, the moon's surface is dominated by volcanic cones and craters, ash flows or fissure eruptions, fault scarps and graben; they propose that the lunar relief, which attains a maximum of 9.7 km., is largely balanced isostatically at depth (in other words, higher elevations are compensated for by deeper roots). This implies that the lunar crust, particularly in the highlands, is a light, siliceous overlay on a denser, more mafic (iron/magnesium-based) substratum.

Although no large-scale active volcanism is visible on the moon, a gas discharge yielding spectra of hydrocarbons containing two and three carbon atoms was observed in the crater Alphonsus in 1958 by the Russian astronomer Kozyrev, and similar events have been reported in Aristarchus and other craters. Infrared images of the moon show anomalous hot spots, probably heated from below.

It is interesting, if not disquieting, that other investigators, looking at the same moon, have seen little or no evidence of volcanism and have concluded that lunar topography has been largely created and modified by a single process external to the moon: meteorite impact. Lunar topography is dominated by craters. Each increase in resolving power from telescopes to satellite cameras revealed smaller craters until it became clear that they occur in all diameters from hundreds of kilometers to one millimeter. Neither this range nor these dimensions are approached, even remotely, on the warm, highly volcanic earth where volcanic surface features range from 30 km. to a few centimeters in diameter.

On the earth, furthermore, volcanic activity is limited to well-defined linear zones, whereas on the moon the craters are (although some dispute this) completely random in distribution. Young craters crosscut the rims and floors of earlier ones with no hint of structural control.

A few lunar craters occur in mountain tops; but the majority are rimmed depressions in the lunar surface, bearing a much more striking morphological resemblance to bomb craters and shell holes than to volcanic craters. The unique rays extending outward for thousands of kilometers from some of the lunar craters, which appear to be even younger than the maria, were shown by the Ranger photographs to be belts of small pits formed by throw-out ejecta. Rays are common around bomb craters, unknown around volcanoes.

Advocates of impact hypothesize that the face of the

Body	Uncompressed density (gm/cm.^{3})
Mercury	5.2
Venus	4.0
Earth	4.0
Mars	3.7
Asteroids (chondritic meteorites)	3.5 to 3.8
Moon	3.3
Jupiter, Saturn, Uranus, Neptune, Pluto	0.5 to 1.9

In general, the density of the planets in the solar system decreases with progressive increase in the distance from the sun. But the moon, with a density of only 3.34 gm./cm.^{3}, clearly is an anomaly among the terrestrial planets. (The figures in the table are uncompressed densities estimated at 0 pressure and 25° C.)

moon has been formed by meteorites of all sizes from a few that were very large (five craters on the visible side are over 200 km. in diameter) to millions of modest scale (over 300,000 on the visible side are over 1 km. in diameter) to billions of tiny particles that constantly bombard the surface, eroding the topography and creating the lunar soil. Some scientists have long suspected that the moon is slowly losing mass as a result of continuous high-velocity impacts that blast target materials out of the lunar gravity field into solar or earth orbits. Evidences of lunar erosion are clearly visible in close-range photographs and on the rocks that were returned to the Lunar Receiving Laboratory. These rocks have rounded edges and textural irregularities reminiscent of sandblasting.

The lunar maria are then viewed as flows resulting from local, temporary heating triggered by very-high-energy events; the observed gas discharges and infrared hot spots are residual effects from relatively recent impacts.

Aside from the topography, certain physical observations support the hypothesis of a cold moon. The moon has no magnetic field and so presumably no metallic core, and this suggests that it has never completely melted. The moon's orbital motions show that it has a disequilibrium shape, which is evidence that the interior is strong enough to resist long-term stress, again implying coldness. The moon has no atmosphere such as would result from the continuous outgassing of a warm interior as on the earth.

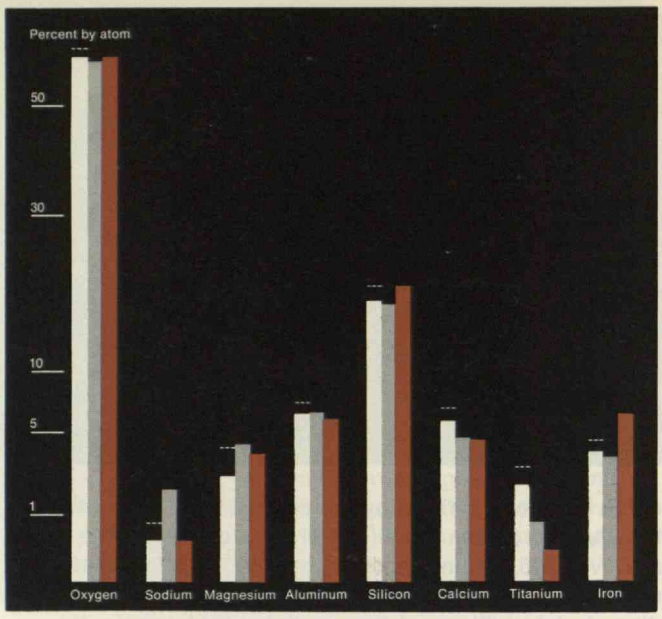
With an escape velocity of only 2.38 km. per second, the lunar gravity field is weak; but it is sufficient nonetheless to hold gases with molecular weights of over 20 (nitrogen, argon, and sulfur dioxide, for instance) for hundreds of millions of years. Yet at present, the moon lacks both atmosphere and ionosphere, and the surface vacuum is more perfect than any reproducible in a laboratory: $\sim 2 \times 10^{-13}$ that of the earth at sea level. Neither a cold interior nor the moon's low gravity can wholly account for this extreme vacuum. Whether the moon is hot or cold, some outgassing must occur, at least locally and sporadically, whenever a large meteorite impacts the surface. In addition, there must be a steady production of radiogenic argon-40 from the decay of potassium-40, and of helium from uranium. Although the lightest gases will quickly dissipate into space, some special explanation is required for the absence of a tenuous but measurable atmosphere. Suggested mechanisms include: thermal agitation during the two-week lunar day when surface temperatures rise above 105° C; ionization by solar ultraviolet radiation; adsorption upon the porous lunar soil; and the sweeping away of the atmosphere by the energetic corpuscular radiation of the solar wind.

One or more of these processes have apparently been effective not only upon lunar gas but upon lunar ice and water. No bodies with the reflecting power of ice or water are visible on the moon, although certain topographic features resembling meandering rivers and playa deposits have been photographed. The interpretation of these features was always highly controversial. As noted above, it is not unreasonable that water should occur, particularly when and if the moon has a warm interior; but the retention of flowing surface water long enough to effect stream erosion seems highly unlikely to many investigators. As alternatives they have suggested that water percolating upward from the interior forms a permafrost layer at shallow depths, and that some of the "riverbeds" are in fact collapsed ice tunnels. Others have proved experimentally that water introduced into a vacuum forms ice which acts as a shield beneath which water can accumulate and flow. Orderly stream channels have not been reproduced in these experiments, however. Those doubting the existence of lunar rivers interpret the valleys as eroded by fluidized gas and dust or as collapsed lava tubes.

The concept that the lunar maria are in fact the dried up relics of lunar seas filled with dark silt or organic deposits met with unequivocal rejection when the astronauts collected heavy, high-density igneous rock from Tranquility Base. These rocks contain no hydrated minerals (not even hydroxyl-bearing silicates), nor do the soils contain any traces of water or sulfur-bearing evaporite salts. In this respect the lunar samples resemble chondritic meteorites much more closely than they do any terrestrial rock. These results suggest that the lunar surface is an essentially anhydrous environment and that water has not been an effective agent in rock or soil formation or in modification of the lunar topography.

Toward a Cold Moon

Among the most persuasive arguments for a cold moon is the lunar shape, which is not a smooth spheroid of



Comparison of the chemical composition of lunar surface material in Mare Tranquillitatis (white) with compositions of oceanic basalts (gray) and eucritic meteorites (brown) known on earth. The values are plotted on a square-root scale with estimated errors indicated for the lunar results. (From A. L. Turkevich, E. J. Franzgrote, and J. H. Patterson, Science, *July 18, 1969, pp. 277-79).*

revolution but rather a triaxial ellipsoid with an apparent bulge toward the earth on the order of a kilometer high. This bulge is observed as a feature of the moon's gravitational field, but it has been widely interpreted as a tidal bulge in the rock, formed and frozen in at some time in the distant past when the moon was much closer to the earth. Alternatively, the gravity-bulge could represent major inhomogeneities of internal constitution. The preservation of either a fossil tidal bulge or an asymmetrical distribution of mass would require a strong lunar interior. This requirement is inconsistent with a molten, or even a warm, moon of low viscosity.

Gravity measurements made by the Lunar Orbiter satellites have recently confirmed, at least in part, the inhomogeneous interpretation of the moon's field. These data show that, in place of one massive bulge on the near side, the gravity field is resolved into several large positive anomalies, some of which are as high as 230 milligals,[1] localized over the ringed maria.

The mascons occupy topographic basins and are clearly caused by large masses of dense rock emplaced in relatively lighter lunar rock. The dense rock may have come from within the moon by magmatic intrusion from depth, or it may have come from outside the moon by the impact and burial of large meteorites. When P. M. Muller and W. L. Sjogren first reported the mascons in August, 1968, they illustrated the magnitude of these anomalies by calculating that the Mare Imbrium mascon could be duplicated by an iron ball about 100 km. in diameter lying at a depth of 50 km. According to later estimates, the Mare Serenetatis mascon could be caused by either a lens of dense rock (one-third again as dense as the moon's average) 600 km. in diameter and 8 km. thick; or by an iron meteorite, 37 km. in diameter buried at a depth of 270 to 400 km. Either explanation involves difficulties.

The lunar maria cover about 35 per cent of the face of the moon and only 2 per cent of the far side. If the maria and their mascons are due to profound magmatic events, ancient or modern, in a heated moon, why are they so limited to one side only?

If the maria result from meteorite impacts, their asymmetrical distribution is almost as puzzling. All meteorites striking the airless moon tend to blast craters and largely destroy themselves in the process. The suggestion is not new that the maria result from exceptionally large impacts, which triggered shallow volcanism by their explosive energy and caused the flooding of the vast, dark lava plains. Now there is a new hypothesis that the meteorites—indeed, 100-km. asteroids—that caused the maria came in at such low velocities that they have survived at depth. Only a satellite in earth orbit could attain so low a velocity. For this reason the suggestion has been made that the impacting bodies were orbiting the earth at an early time when the moon was much closer and moving outward. These bodies collided with the moon's farside which, thus made heavy was later pulled around and locked into a synchronous orbit facing the earth. Whatever their origin, the preservation of these gravity anomalies in maria that appear to be at least 3.5 billion years old, without homogenization of mantle rock, isostatic adjustment, or a slow sinking to the moon's interior, argues persuasively for a strong outer shell on the moon.

Density and Composition

Prior to the advent of artificial satellites, the moon's density of 3.34 grams per cubic centimeter was the best available clue to its composition. This density is surprisingly low. The earth's mean density is 5.52, and if it were a smaller, uncompressed body the size of the moon, the earth's density would still be 4.04. Their densities reflect a significant chemical difference between the earth and the moon.

Further examination shows that the moon is also lighter and therefore in some way chemically different from every other body among the terrestrial planets of the solar system. From the sun outward, the planets decrease in density, as is shown in the table. In this density gradient, the moon clearly belongs beyond the asteroids, at the interface between the small, heavy terrestrial planets and the huge, light icy planets. This has led to the proposal that the moon is a captured asteroid, a newcomer to the vicinity of the earth. Two problems, at least, plague this hypothesis, both of which

[1] The gal, named for Galileo, is a unit of gravitational acceleration, equal to 1 cm./sec./sec.

can be reserved for discussion in connection with comments on the moon's origin.

Given its mean density of 3.34 g./cc., the moon was expected to have a crust somewhat lighter and an interior heavier than this value. Contrary to all predictions, the igneous rocks collected at Tranquility Base proved to have densities ranging from 3.1 up to 3.5 g./cc. Thus some surface rocks, and, by inference, large areas of them, evidently have densities greater than that of the body as a whole.

One large body of rock exists that has almost precisely the density of the moon: the earth's upper mantle. To derive the moon from the body of the earth, particularly after the formation of the earth's core, provides an elegant solution to the density problem. It raises dynamic and chemical problems, however, that have caused most investigators to reject this mechanism, which will also be considered in the section on the moon's origin.

Lunar Surface Analyses

In 1967 and 1968, three of the Surveyor satellites accomplished soft landings on the moon and made the first chemical analyses of the lunar surface, by means of the alpha-scattering technique. Surveyors 5 and 6 measured sites on Mare Tranquillitatis and Sinus Medii. Surveyor 7 sampled the highlands just outside the crater Tycho. The first preliminary results published by Anthony L. Turkevich of the University of Chicago and his co-workers indicated that the two maria sites bore a general resemblance to basalts (both terrestrial basalts and basaltic achondrite meteorites); the highland site was relatively low in iron and differed from all known rocks.

After nearly two years of data reduction, the final results of the Surveyor 5 analysis at Mare Tranquillitatis were published in *Science* on July 18, 1969—when Apollo 11 was approaching the moon to land at Tranquility Base. The corrected analysis is lower in sodium and iron and higher in titanium than the preliminary one. These seemingly minor changes are critical to the geochemistry of the moon. The analysis is no longer a close match for basaltic achondrites or for any terrestrial rock or mineral, although it is still broadly basaltic in character. The low iron content was forseeable because of the moon's low density; no evidence was available for predicting a significant enrichment of titanium over the average values in the earth and in meteorites.

The titanium enhancement has been fully confirmed—indeed, its value has been increased—by analyses of the rocks and soils collected by the Apollo 11 astronauts. These rocks contain 7 to 12 per cent titanium dioxide, whereas terrestrial basalts contain about 2.0 per cent and basaltic achondrites contain 0.4 per cent. On earth, the richest titanium lodes rarely run over about 5 to 6 per cent titanium dioxide, but on the moon much higher values occur in igneous rocks, breccias, and soils and thus must represent large volumes of the surface. The lunar materials also show striking enrichment in zirconium, yttrium, and chromium relative to basalts and meteorites. On the other hand, they are low in the alkalis sodium, potassium, and rubidium. Of special interest is their low rubidium-strontium ratio which, like that of the earth, is depleted relative to chondritic meteorites.

Chondrites are commonly used as a chemical standard because they are relatively primitive, undifferentiated stony meteorites with a bulk composition very similar to that of the condensed elements in the sun. The assumption seems reasonable that all bodies of the solar system condensed from the same starting materials—the solar nebula—and that chondrites, which are about 4.5 billion years old, are similar (although by no means identical) to this primordial material.

The density difference between the earth and moon has commonly been interpreted in terms of iron abundances. The probable total iron content of the whole earth is about 30 per cent; that of ordinary chondrites is 26 per cent. Pre-Apollo estimates of iron in the moon were about 10 per cent; the maria rocks analysed in Houston range from 12 to 16 per cent, but the highland rock measured by Surveyor VII ran less than 3 per cent iron.

Meteorite impact appears to have been an important process on the moon; this is shown by an abundance of shocked rock and impact glass in hand specimens and soils. It is interesting, therefore, that nickel and cobalt are both vanishingly low in the lunar materials, contrary to many predictions of nickel-rich accumulations. In general, the lunar rocks may be described as mafic types consisting of pyroxenes and calcium-rich plagioclase feldspar with minor olivine and accessory ilmenite. The minerals are the same species occurring in basalts but in different proportions. Chemically the highland Surveyor analysis matches no known rock, whereas the maria analyses approach those of terrestrial basalts and basaltic achondrites but with such radically different minor element abundances that the geochemistry of the moon will be long in becoming understood.

The combined results from the Surveyor and Apollo missions seem to have rendered several models of lunar composition unlikely: the lunar surface does not resemble chondritic meteorites, condensed solar material, or terrestrial ultramafic rocks; both maria and highlands contain too little magnesium and too much calcium and aluminum for these materials. The maria are wholly unlike tektites (which many investigators have believed are

lunar impact glass), and the highland site near the crater Tycho contains too much magnesium, aluminum, calcium, and iron and too little silicon for tektites. Furthermore, three of the four tektite groups derive from siliceous parent rocks having ages (measured by their strontium-rubidium isotopic compositions) of only 400 million years, which now appears too young by about an order of magnitude for the lunar crust.

The unique chemistry of the moon's surface indicates that it cannot be a primitive body; it has undergone some degree of chemical fractionation—albeit at a very early stage of its history. The apparent long-term coldness and rigidity of the moon may result from the fact that an early episode of melting and volcanism dissipated most of the moon's internal heat, which has never been restored because of insufficient radioactive material at depth.

The Origin of the Moon: Still the Central Mystery

The moon became an earth satellite by one of three mechanisms—fission of the earth, capture, or accreting independently in the vicinity of the earth. In order to choose between these possibilities, both the moon and the earth must be examined for pertinent evidence.

The Fission Hypothesis

The birth of the moon from the body of the earth was first proposed by George Darwin in 1879. He argued that the original large, primeval body rotated with a period of four hours, set up resonance between its free oscillations and the solar tides, developed an enormous bulge, became unstable, and finally threw off one or more fragments which formed the moon. In 1907, W. H. Pickering suggested that the Pacific Ocean basin is the scar resulting from this catastrophe and that the remaining sialic crust on the earth ruptured and the continental blocks drifted apart.

The fission hypothesis provides an excellent solution to the moon's low density, if fission occurred after formation of the earth's core, as it matches the density of the upper mantle. The hypothesis has long been in general disrepute, however, mainly because of dynamical problems involved in accomplishing fission of a large planet followed by the escape of one or more large fragments. Enormous amounts of energy must be dissipated without heating the earth to temperatures that would have driven off even more of its volatile elements. One version of the fission hypothesis, proposed by John O'Keefe of Goddard Space Flight Center, involves splitting of the protoplanet into a contact binary system with subsequent loss of much matter and angular momentum from the lunar body. High temperatures would cause the observed depletion of alkalis and volatiles from both bodies. This general model may bear re-examination now that we know maria rock is severely depleted in alkalis and is in other ways more broadly earth-like than chondritic in composition.

The Capture Hypothesis

The moon's low density and tilted orbit suggest to many that the moon formed elsewhere and was captured by the earth. Its density is appropriate only to the far reaches of the asteroid belt, but it does not actually match that of any of the stony meteorites of presumed asteroidal origin. A second problem is posed by the moon's mass which is some 97 per cent greater than that of all of the present asteroids combined. Thus, if the moon was born in the asteroid belt it was by far the predominant body. The hypothesis requires that it was somehow ejected into a highly eccentric orbit, captured by the earth, and perturbed again into a nearly circular, but strangely tilted orbit. The mechanics of so catastrophic an event, in the general orderliness of the solar system, are all but impossible to visualize. Most proponents of capture now seem agreed that the moon was moving in an orbit similar to that of the earth when captured.

One of the strongest advocates of lunar capture is Harold C. Urey who, persuaded by the geophysical evidence for a cold moon, worked out a theory that the moon is a primitive object with a bulk composition similar to that of the condensed solar nebula. This composition would account for the density and, according to his calculations, for the low internal heat. He regards the moon as 4,500 million years old with topography formed by impact which, in the maria, resulted in melting at shallow depths. He suggests that the moon formed and was captured in the region of the solar system near the earth.

Although chemical evidence now indicates that the moon is neither solar in composition nor wholly primitive and undifferentiated, Professor Urey's hypothesis that the moon is very old and formed near the earth may well be our best guide to deducing the details of lunar history.

If the earth suddenly acquired the moon, the results in ocean tides and tectonic disruptions should have been spectacular enough to show in the geological record. Several investigators have searched for and reported phenomena that might mark the capture of the moon. For example, Preston Cloud has pointed out that Precambrian stromatolites, 1 to 2 billion years old, record very great amplitudes for the ocean tides of that period, which proves that the moon was then orbiting the earth at close range. Working backward from there, he postulates that the earth's crust, which has yielded no dated minerals older than 3.5 billion years, underwent a catastrophic melting and outgassing that re-set all atomic clocks 3.5 aeons ago. This is the date he postulates for capture of the moon.

Norman Herz of the U. S. Geological Survey has collected data on the age and distribution of anorthosites, rocks consisting almost exclusively of calcium-rich feldspar and accessory magnetite. He finds that all anorthosites are Precambrian with ages ranging from 1.1 to 1.7 billion years but clustering about 1.35 billion years. When anorthosite outcrops are plotted on pre-continental-drift reconstruction maps, they lose their random distribution and line up in two belts, one in the northern hemisphere (Laurasia) and one in the southern (Gondwanaland). He concludes that anorthosites are deep seated rocks from the lower crust or upper mantle that were emplaced near the surface as a result of a unique catastrophe about 1.3 billion years ago. He sug-

gests capture of the moon at that date. If he is right, anorthosites bear witness to two highly controversial occurrences, lunar capture and continental drift. Hannes Alfven of the Royal Institute of Technology, Stockholm, has suggested that the moon was captured in a retrograde orbit which brought it close to the earth until it reached the Roche limit, at 2.8 earth radii, where tidal disruption exceeded the moon's gravity and the moon shed great tonnages of coarse blocks and fine sand, accounting for part or all of the sialic crust of the earth. The loss of mass from the moon and its gain on the earth reversed the angular momentum of the system causing the moon to recede in a prograde orbit, being bombarded and cratered en route by what was left of its own debris. If this event occurred, it must have pre-dated the formation of the earth's crust and lunar maria 3.5 billion years ago; but derivation of the earth's crust from the moon is an interesting counterpoint to the older theory of deriving the moon from the earth.

Those who oppose the capture theory do so mainly because of its low intrinsic probability. Capture of a body from the far reaches of the solar system imposes insoluble dynamic problems, and capture of a body already in an orbit like the earth's implies independent accretion of a large, low-density body in this region of the solar system.

The Accretion Hypothesis

Many astronomers and geophysicists find comfort in postulating that the moon is a permanent part of our system that grew simultaneously with the earth by accretion from a cloud of cold solar dust and gas. But such a cloud is customarily pictured as homogeneous, and this leaves the density problem unsolved although Professor Egon Orowan of M.I.T. has suggested that cold welding of metallic dust particles might cause primary accretion of a dense metallic core, leaving the fringes of the cloud enriched in silicates.

Two accreting bodies must have maintained a very sensitive balance between their size and orbital energies. As the earth grew more massive and exerted greater gravitational pull, the growing moon must have constantly gained momentum at the right rate to keep independent and not fall into the earth or escape into solar orbit.

To date, no theory of lunar origin can claim support by a majority of lunar scientists. In the recent past at least two investigators, Professor Urey and Gordon J. F. MacDonald, have reviewed the problem in detail and concluded that no method for the origin of the moon is possible; the moon cannot exist.

Toward a Unified Lunar Theory

This wry conclusion was justified by the conflicting fragments of circumstantial evidence available up to the present time. Hard data collected on the Apollo missions may remedy this situation. Radiometric dating of lunar rocks has already established that the moon is a very old body, probably as old as the earth (4.5 billion years). Trace-element analyses of potassium, sodium and rubidium show that, like the earth, the moon is severely depleted in alkalis. The mineralogy of the maria indicates high-temperature crystallization under anhydrous conditions, and all present evidence is against an active role for water in lunar soils and topography.

The composition of lunar surface rock clearly suggests magmatic differentiation but its age indicates a very early date in lunar history. The cosmic ray exposure ages of only 20 to 160 million years measured on rocks that crystallized some 3.5 billion years ago suggests either a constant wearing away of the lunar surface by a process similar to sandblasting, or a sudden throwout of these rocks from impact craters.

The multichannel seismometer sensor emplaced at Tranquility Base by Armstrong and Aldrin can distinguish the movements of deep-seated magmas from sudden slippage along fault planes or point source vibrations from meteorite impacts. The laser reflector will enable precise measurements of the motions of the moon and a refined interpretation of its gravity field and shape.

Earth-based studies have been far from adequate for an understanding of our unique satellite. The Apollo 11 mission and Neil Armstrong's "giant leap for mankind," which took place within about two million days of the invention of the wheel, have demonstrated our mastery of a superb technology. Within another year the scientific results should lead, for the first time, to a unified theory of the moon and a greatly enhanced understanding of the earth and the solar system.

Suggested Readings

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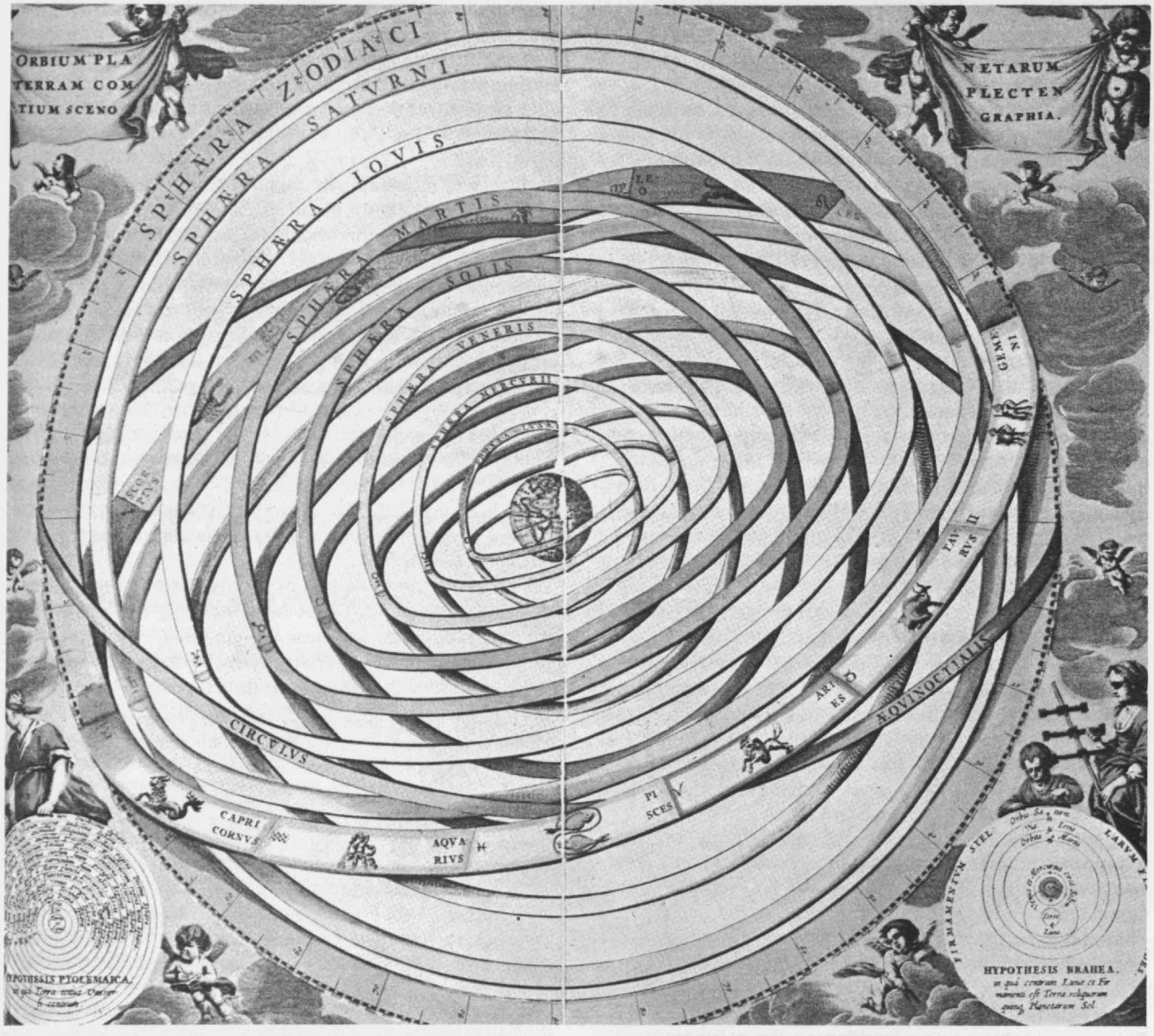
With her husband, Thomas C. Marvin, an economic geologist, Dr. Marvin spent six years mapping and searching for ore deposits of magnesium and titanium in the U.S., South America, and West Africa for the Union Carbide Corp., and for three years taught mineralogy and petrology at Tufts University. Since 1961, she has devoted full time to research on meteorites, cosmic dust, impact structures, and the geological implications of satellite geodesy at the Department of Geological Sciences, Harvard University and the Smithsonian Astrophysical Observatory. She is co-investigator on a program to do mineralogical research on the returned lunar sample.

Three hundred years ago the motions of the planets—and the true nature of the solar system—remained a subject of conjecture for all mankind. Today planetary geometry is being refined to remarkable accuracy through radio astronomy and space vehicles; but the origin of the solar system is still the subject of intense and unrewarded curiosity.



A single postulate shows how the earth and its neighbors in the solar system might have formed in an immense blast furnace of showering particles—and in a minuscule instant of geological history.

Don L. Anderson
Director of the Seismological Laboratory,
California Institute of Technology

A History of the Terrestrial Planets

Perhaps it seems presumptuous to consider the interiors of the other planets when man has yet penetrated by drilling and mining something less than 5 kilometers into his own. However, geophysicists have made a science out of determining what is beneath their feet, and the amount of information that can be obtained by geophysical methods in advance of drilling is quite spectacular. Indeed, by these indirect methods we have learned a good deal about the very deep inaccessible interior of the earth. It is only natural, then, that geophysicists are now talking about the interiors of the other planets, and with—I might add—more assurance in some respects than they have about the interior of the earth.

What is it that we know about the other planets that makes us so well informed about their internal states, and perhaps even their constitutions?

We know their masses and their sizes, and thus we know the mean densities. We can say that, with the possible exception of Mercury, the other terrestrial planets (Mars, Venus, the moon) have approximately the same composition and are slightly less dense than earth.

This would hardly be surprising if they were all made out of the same material, since they are all smaller, and the effect of size is to decrease the pressure and hence the density of material. But although the differences between the densities of the terrestrial planets are fairly small, they are nevertheless more significant than this; they are sufficient to suggest small differences in composition and perhaps in modes of evolution. Hence we attain some insight into the composition of the preplanetary material that was originally in the vicinity of each of the present planets, and into the way in which this material may have been brought together.

For Mars we have one piece of direct astronomical information. We know the amount of the flattening due to rotation. With certain assumptions this tells us very crudely how large a mass concentration there is toward the center of Mars. We know, in fact, that if Mars contains an iron core, as the earth does, it must be very small; there may be no dense core at all. (The absence of a magnetic field on Mars suggests the same thing, though we do not know enough about the origin of magnetic fields for this to be conclusive.)

If this is all the data we have, how can we manage to work out a model for the interiors of the planets and for their origin and evolution?

Extrapolations from the Earth

The biggest advantage we have in this enterprise is our knowledge of the internal structure and composition of the "prototype" terrestrial planet—the earth itself—most of which knowledge has come from seismology. It behooves us to apply what we know about the earth to the other planets, and to check our theories about the origin and evolution of the other bodies in the solar system against what we know of the earth.

We also have some general principles which must apply to the interiors of planets. We know that the earth-forming materials such as rocks undergo very large phase changes—abrupt changes in density—under high pressures. There are at least two major solid/solid phase changes in the earth's mantle, and together these result in a 20 per cent increase in the density of a common rock. We also know the equations of state of many common rocks and rock-forming minerals very accurately.

So we know the effects of pressure and temperature on density, and we know that the common planet-forming materials undergo very large changes in volume due to collapse of their crystal structures. This last item—the fact that rocks cannot survive in their "open" structures, as we know them at the surface, when they are subjected to pressure in the interior (just as carbon ultimately collapses to diamond)—is a very important fact often overlooked in the design of models for the interiors of other planets.

We also know that some of the objects in the solar system are about 4.5 billion years old, and that the earth's crust and oceans were formed less than 1 billion years later. In other words, we have very important time constraints on the evolution of the earth, the meteorites, and the other planets. (From dating rocks that still possess the magnetism with which they were formed, we know that the earth had a core at least 3 billion years ago. We even have some evidence in old sedimentary rocks that life itself began to form on the earth more than 3½ billion years ago. And the mere fact that there *are* old sedimentary rocks suggests that there was liquid water on the surface of the earth at that time.)

It thus becomes apparent that much of the early evolu-

A hint of the complexity of hypotheses about the solar system—and of the achievement which man's present knowledge represents—can be gained from this description of the sun and planets related to familiar terrestrial geography. If the sun were a 600-foot (diameter) ball in the center of Boston's Logan Airport, Mercury would be a two-foot ball 4½ miles away, in the Back Bay; Venus a 5¼-foot ball in Newton (9 miles); Earth a 5½-foot ball in Waltham (12¼ miles); and Mars a 3-foot ball 18½ miles away in Wayland. Then comes Jupiter, an immense 60-foot balloon half way between Worcester and Springfield, 64 miles from the "sun."

tion of the earth took place in a very short period of time, that the earth was already in an advanced stage of evolution shortly after it formed; even in the process of formation the earth may have been starting to differentiate and form a core. This means that most of the violent action took place very early in the earth's history.

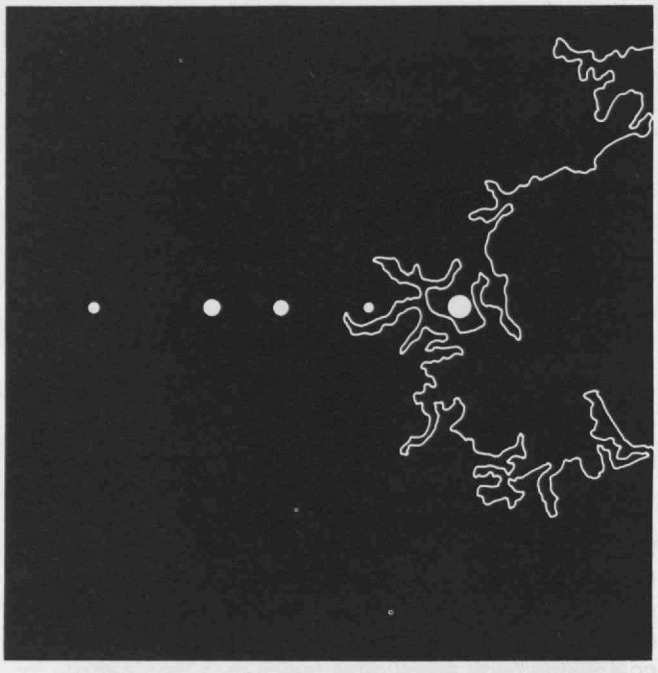
A "Hot" Start, or a "Cold" One?

Before it was discovered that radioactivity is serving to heat up the earth, it was commonly believed that the earth started as a ball of molten material, which has been cooling off ever since. In more recent years it has been believed that the earth formed by the accretion of very small, very cold particles, that the original earth was very cold, and that it has been warming up, through the decay of the radioactive elements contained in its accreted particles.

But the ages of the earth, its core and its oceans, which I have outlined above, serve to contract the period available for the early geological history—differentiation into a crust, a mantle, and a core, and outgassing. The timing of events suggests that temperatures inside the earth be at least great enough to melt iron less than 1 billion years after the earth was formed.

This is an extremely powerful constraint both on the time it took for the earth (and, by analogy, the other planets) to accrete; and on the amount of radioactivity in the earth's interior. Indeed, the existence of old magnetic rocks and the evidence for old crustal rocks in water-laid sediments suggest that the earth formed in something like 100,000 years or less, and that much of the heat in the earth's deep interior is not due to radioactive heating but is left over from energy generated in the original events of formation.

Seismic studies reveal complex step-like structures in the upper mantle—the upper 1,000 kilometers—of the earth. These are due to phase changes—solid/solid and probably also solid/liquid. There are levels where seismic waves are attenuated most rapidly and, by analogy, where tidal dissipation (a wave phenomenon, albeit a low frequency one) acts most effectively. Most of the dissipation of tides in the earth takes place in the outer 1,000 kilometers, leaving very little tidal amplitude at the core-mantle boundary which would otherwise dissipate a great deal of tidal energy. So, at least in the case of



the earth, we could not tell from tidal measurements whether or not there was a core.

In the same way, it is not proper to conclude simply from tidal dissipation data that Venus has a core, for we cannot be sure that there is no partially molten zone in the upper mantle of Venus. Indeed, the possibility of such a zone seems very great, because the surface temperatures on Venus are so much higher than on the earth.

The Most Significant Event in Terrestrial History

The core-mantle boundary, at a radius of about 3500 kilometers, is the most profound discontinuity in the earth. It separates the solid silicates of the mantle from the molten iron of the core, and it is here that our most interesting postulations about terrestrial history find their focus.

As Francis Birch once said, the formation of the liquid iron core was probably the most significant event in the history of the earth; it was obviously a very traumatic event—perhaps even a catastrophic one.

We assume that the iron was initially scattered throughout the body—or even located near the surface—and

Postulations about the formation and differentiation of the planets hinge critically upon the temperatures involved. Gravitational energy is transformed into heat energy in the process of accretion and core formation; and radioactive decay adds considerable heat. If the temperature of the materials accreting to form the earth is placed at about 1000° K it can be shown that the melting point of iron—and hence the beginning of core formation—is reached so early in the planet's history that it is in fact still accumulating material. Identical assumptions for Mars result in temperatures everywhere below the melting point of iron—and hence support the present evidence that Earth has a molten core while Mars, far less dense, has a solid core.

that it sank through the whole earth to accumulate at the center. It is not easy to picture how much material was moved, and over such great distances, in such a process. Clearly the event put a thermal pulse into the earth (by the dissipation of gravitational potential energy) which essentially wiped out the geological record up to that time, and in a sense reset the geological clock. Indeed, it is possible that the formation of the core took place while the earth was still gathering material from space; it may in fact represent the start of geological history.

What sort of circumstances could have led to the formation of the core? We can hypothesize, for example, a body accreting from small particles at 100° K—relatively cold—with a gradual temperature rise due to the material being compressed in conditions where energy could not be lost to space. But under this hypothesis the earth could not have reached the melting point of iron in the whole time that has elapsed from the beginning to the present—much less, within the first billion years. We can show that even by accreting slightly hotter particles —about 330° K—the earth would only now have reached the melting point of iron.

These postulates ignore the energy contributed by the infalling particles from their gravitational descent through space, which is converted to heat upon impact. If all the gravitational energy released in accreting a body such as the earth were converted into heat, the body would end up with very high temperatures indeed. The larger the body and the faster it grew, the hotter its surface would become. However, only a fraction of this energy, generated at the surface, could remain within the body; much would be radiated to space.

If we include this gravitational energy of accretion and if we assume a reasonable accretional history, we can develop a thermal history which brings the earth to the melting point of iron at 1½ billion years of age. At that point core formation would begin, and this would provide a great deal more thermal energy which would raise temperatures throughout the body by a substantial amount. Immediately after core formation, temperatures would exceed the melting point of iron throughout the mantle; so core formation would very extensively melt the outer portions of the earth. The present low-velocity zone (where seismic waves travel slowly, that is), probably due to partial melting, could readily be a remnant of this situation.

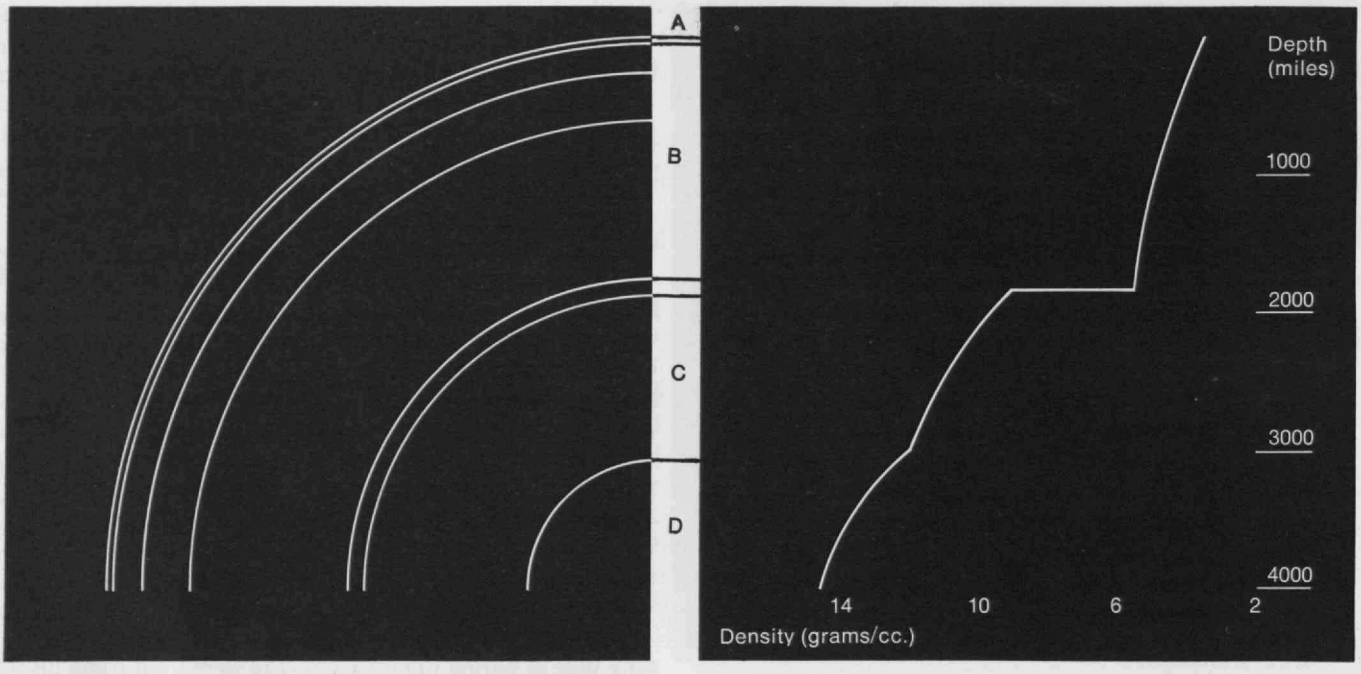
The time scale of accretion postulated here is relatively rapid, but still not fast enough to fit the observations previously cited. But if the rate of accretion is further increased so as to reduce the accretion time to 170,000 years, it becomes possible to postulate, depending on the amount of radioactivity we have in the body, temperatures in the mantle reaching the melting point of iron within the required 1 billion years. And this is the conclusion we reach about the formation of the earth—and, by analogy, the other planets.

If we assume the same rate of accretion for Mars, and the same gravitational temperature effects, we conclude that Mars would remain below the melting point of iron. This suggests verification of our previous inference that Mars contains no heavy, fluid core.

This figure of 170,000 years for the accretion of the planets represents an extremely rapid event on the geological time-scale. Perhaps the early history of the solar system was after all only a very minuscule fraction of geological history.

A more detailed analysis of this postulated mechanism

Changes in seismic velocity with depth and a knowledge of the effect of its rotation upon the earth's shape lead to these estimates of the density of Earth in the crust (A), mantle (B), outer core (C), and inner core (D). Such data are essential to computations of interior temperatures and structures, from which can be extrapolated hypotheses about other planets in the solar system. (Chart: Hurley, How Old is the Earth?, *from K. E. Bullen)*



for the heating of the primordial earth can be made to yield a history of the surface temperature as a function of the earth's increasing radius, as the planet grew. By the time the earth was only about 20 per cent of its present radius, it seems surface temperatures were up to 1000° K. This means that oxides and silicates, falling on to it through a chemically reducing atmosphere such as hydrogen gas, could at once have been reduced. In other words, we can conceive of the earth as a kind of immense blast furnace in which iron silicates and iron oxides were reduced to the free iron needed to form the core, while the planet was yet growing—beginning when it had achieved only about one third of its present size.

What of the compositions of the other earth-like planets? As our knowledge of their orbits improves, we know better and better their masses and densities. We know that Venus is less dense—with probably slightly less iron—than the earth. Mars is still less dense; it appears to have less iron than Venus. The moon has very little iron, and it seems to have essentially the same composition as the earth's mantle. There is still a large uncertainty in our figure for the radius of Mercury, but it is clearly a very dense body; it is probably very rich in iron.

These observations relate to our postulated history of the terrestrial planets in an important way. If we considered Mars to be simply a scaled-down version of the earth, we would have a smaller core, less dense because the pressures are less. On this basis we would envision a body with the observed Martian density, but the wrong moment of inertia. In order to explain both the mean density of Mars and its moment of inertia we are forced to construct a model which has little if any iron core—and this becomes consistent with our thermal history calculations.

There is indeed, then, a single postulate by which it is possible to account for temperatures in the earth enough to initiate core formation while, with the same assumptions, accounting for Mars never reaching the melting point of iron, or indeed the reducing conditions probably prerequisite for core formation.

Don L. Anderson's career in geology and geophysics began in the field of arctic studies and seismology at the Air Force Cambridge Research Laboratories and the Arctic Institute of North America. He first went to California Institute of Technology for graduate study in 1958, received M.S. (1959) and Ph.D. (1962) degrees there, and has been a member of the Caltech faculty ever since . . . currently as Professor of Geophysics in the Department of Geology as well as Director of the Seismology Laboratory.

While still in kindergarten, science was already moving to make Dennis Twining a hot property.

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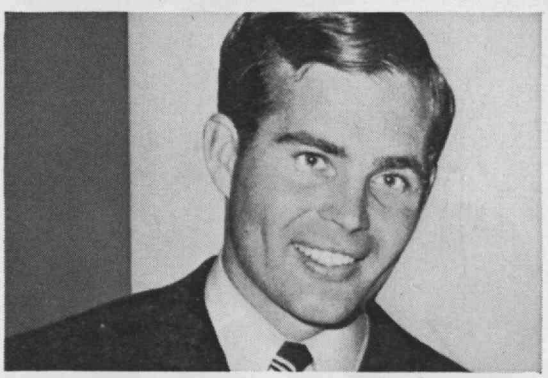
"Here I am on Wall Street, past halfway to my MBA at NYU with a thousand opportunities in front of me.

"Yes, Sputnik took me quite a way."



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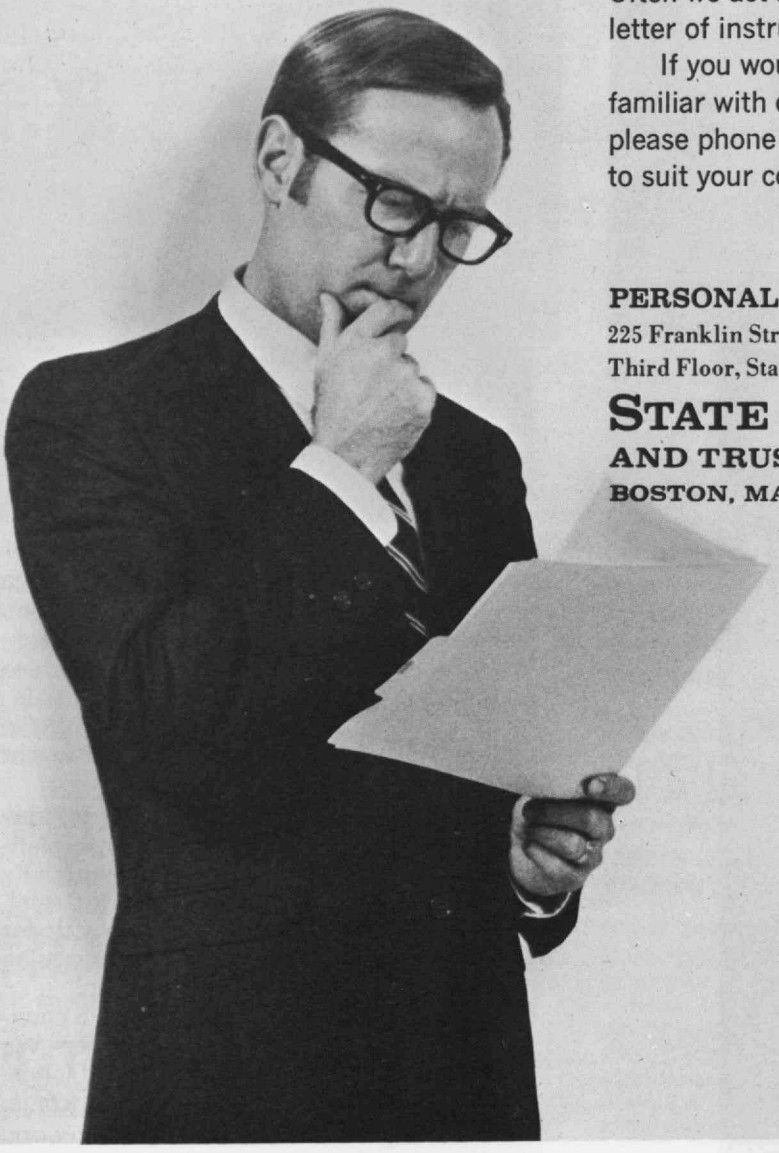

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Trend of Affairs

Ice-Crusher for the Northwest Passage

The attempt to open up the Northwest Passage from the Atlantic to Alaska for year-round commercial use has been pioneered by a ship which owes its present form to work done at M.I.T.'s Department of Naval Architecture and Marine Engineering. The ship, *S.S. Manhattan,* was built in 1962, the largest merchant ship ever to sail under the U.S. flag—115,000 dead-weight-tons, 940 feet long. It still has this distinction, plus the further one of having been, in the past few months, cut in four pieces, made heavier by 9,000 t., and lengthened by 65 ft.

The extra 65 ft. results from replacing the conventional bow with an ice-breaking version, best described by reference to the diagram. The new shape has its origin in a doctoral study completed at M.I.T. in 1965 by Roderick M. White, who is now Chief of the Applied Engineering Section of the United States Coast Guard Academy, New London, Connecticut.

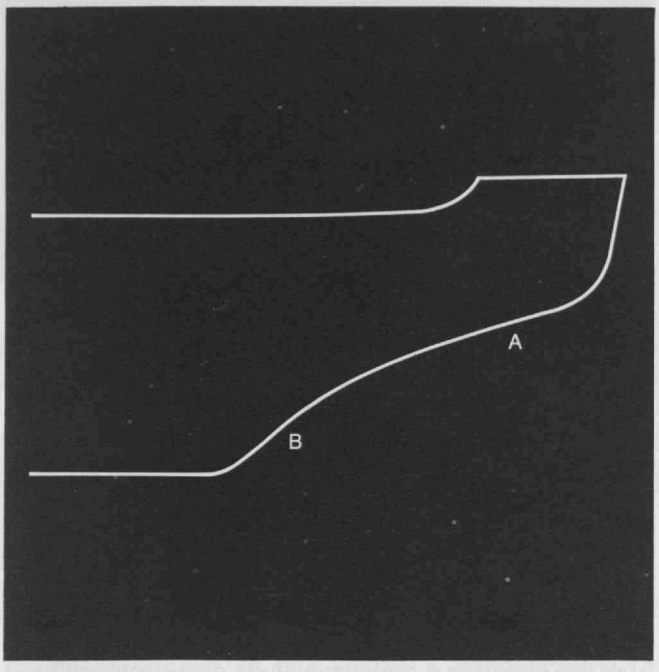
Commander White's thesis was primarily a contribution to the mathematics of the ice-breaking process, making it possible to relate design to performance in a scientific manner. There are two ways in which a ship can make its way through a layer of ice: steadily, or by ramming. In difficult conditions, the ship inevitably resorts to ramming, which generates forces an order of magnitude greater than those of steady-state icebreaking. Unfortunately for designers, ramming is a complex process, dynamically: forces are generated from the deceleration of the ship, and also (depending on the bow profile) from its weight as it rides up on to the ice.

The most important component of the force on the ice is the downward one, this being the direction of least strength. Previous to White, the classic work on the mathematics of ramming was that of a Russian, I. V. Vinogradov, published in 1946.

White produced a computer program for calculating the downward force in terms of 15 characteristics of the ship (velocity, thrust, numerous form characteristics, and dynamic frictional coefficient against ice). He identified eight design criteria for maximizing the downward force during ramming, and recommended the bow shape shown in the opposite diagram. The stem of the ship strikes the ice at a very shallow angle, generating a large inclined-plane force, and then rides up. The lower part of the bow curve is steeper, to make it easier to extract the ship after ramming. In a plane perpendicular to the stem the bow is blunter than has been usual in previous icebreakers.

The new Alaskan oil fields have led the Humble Oil and Refining Company, and others, to take very seriously the idea of shipping oil through the Canadian ice in giant tankers (nothing bigger than about 50,000 dwt. will pass the Panama Canal, and bigger tankers offer considerable economies). The White recommendations are now embodied in a design for a tanker of 250,000 dwt., which

In his M.I.T. doctoral thesis, Roderick M. White indicates a bow profile adopted for the S.S. Manhattan *such that the stem makes an angle of 15° with the horizontal at A, 30° at B. The shallow forward angle gives a large sustained force on the ice during ramming, while a relatively small peak load is exerted on the ship. After the bow has ridden up on the ice, the larger angle at B makes it less difficult to back out.*



would cost Humble $50 million apiece. But practical experience is needed before such an expensive move can be undertaken (Humble contemplates six such tankers, and the whole Alaskan industry could keep 25 or 30 of them busy). Hence Humble's purchase and modification, along Whitean lines, of the Manhattan.

The Draft Versus the Colleges

Current draft regulations are having a devastating effect on the supply of top level scientific and engineering manpower from the nation's graduate schools. According to a letter from the Engineering Manpower Commission of the Engineers Joint Council to Lee A. DuBridge, Science Adviser to President Nixon, the current draft priorities result in "the preferential induction of advanced students and recent graduates out of proportion to their percentage in the draft-liable population and in excess of the needs of the armed forces for skilled personnel."

The Commission recommends that graduate students in good standing be temporarily deferred until Congress has acted on the proposed legislation to select men at random from a prime age group. The plan would not permit deferments to be pyramided into total exemption but would correct the inequity of drafting the older graduate students first.

In the alarming decline in graduate school enrollment, engineering and science students have been hit proportionally harder than those in other graduate disciplines ("Engineering enrollments are 98 per cent male"). Many American males are being replaced in graduate schools by foreign nationals; one third of engineering enrollments are foreign students. These students cannot be expected to remain in the U.S. as a continuing source of manpower.

The decline in graduate enrollments will hit colleges and universities the hardest because most faculty members are recruited from the student population. "Deficiencies in the teaching faculties would be reflected in the output of their institutions. The decline of graduate programs can have only unhealthy consequences for the country."

The findings of the Engineering Manpower Commission are fully supported by studies released in July by the Scientific Manpower Commission. In a general survey of various fields such as mathematics, history and medicine, an overall drop of 5.6 per cent in full time first-year male graduate enrollments was recorded for 1968-69. Special studies of chemistry, physics and psychology departments showed varying results: chemistry, a drop of 6.4 per cent; physics, less than 1 per cent; and psychology, 9.2 per cent. Normally, an increase of 10 per cent would have been expected on the basis of population and normal enrollment increases.

More important, the survey of almost 600 Ph.D.–granting departments in these three fields showed that 15.4 per cent of first-year U.S. males and 11.8 per cent of second-year U.S. males had entered the service or been ordered for induction prior to June 1969.

The effect of the draft differed among the three disciplines and in various departments, but most respondents to the questionnaire noted that statistics tell only part of the story. Not included in the figures were those who dropped out of school to seek jobs with occupational deferments, and the number who had changed from full-time student to full-time teaching status.

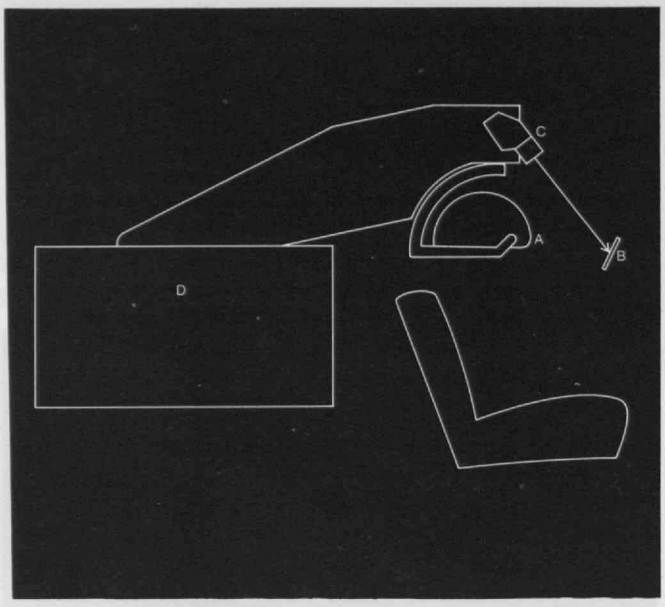
Possible losses for the 1969-70 academic year are not yet known, but many students accepted for graduate work had, since April, withdrawn because of the draft.

Simulated Hazards on a Real Road

How do drivers actually respond to hazards on the road? Because of the difficulty of experimentation, much less is known about this factor of highway safety than about automobile design and good road construction.

Experimenting with real risk situations is out of the question, so what is required is some kind of simulation. Charles Cornell, a graduate student in the Engineering Projects Laboratory at M.I.T., has approached the problem in a novel way by using, instead of the usual stationary driving-simulator, an actual car and an actual de-

A simplified drawing of apparatus for giving a driver the illusion of an approaching vehicle. The helmet (A) is free to move in all six degrees of freedom (most of the moving parts between the helmet and the rigidly-mounted computer (D) are not shown). The transparent screen (B) and projector (C) are rotated together about a vertical axis which passes through the mid-point between the driver's eyes; the projected image is varied to simulate changing distance.



serted road. A computer-positioned image of another vehicle is superimposed on the roadway that the driver sees while operating the car.

The viewing system is based on the head-up displays used in aircraft instrumentation. The driver wears a helmet attached to the computer assembly, and, as he views the roadway, looks through a transparent screen angled so that it reflects into his eyes the image of a highway hazard, projected from behind. The mechanical linkage between the helmet and the screen is such that the driver has complete freedom of movement, yet the image is always reflected at his eyes, and from the appropriate direction.

The projection apparatus, positioned above and behind the driver, leaves him the use of side and rear windows. The simulation mechanism consists of a light source and an iris diaphragm, a small analog computer, and servo circuitry that controls the position of the display and maintains the illusion of distance. The oncoming vehicle, in the present version, is represented as a single headlight; thus, only night driving can be simulated. The apparent distance of the headlight is controlled by the size of the iris aperture.

The advantage of the on-road simulator over stationary ones is that the driver not only has visual and auditory cues but also the motion cues and spatial orientation of an actual car. Cornell contends that the impression of realism is especially vital to research, for drivers must feel personally in danger to respond realistically to emergency situations. Everything in his model is real except the obstacle, and the only thing missing is other traffic.

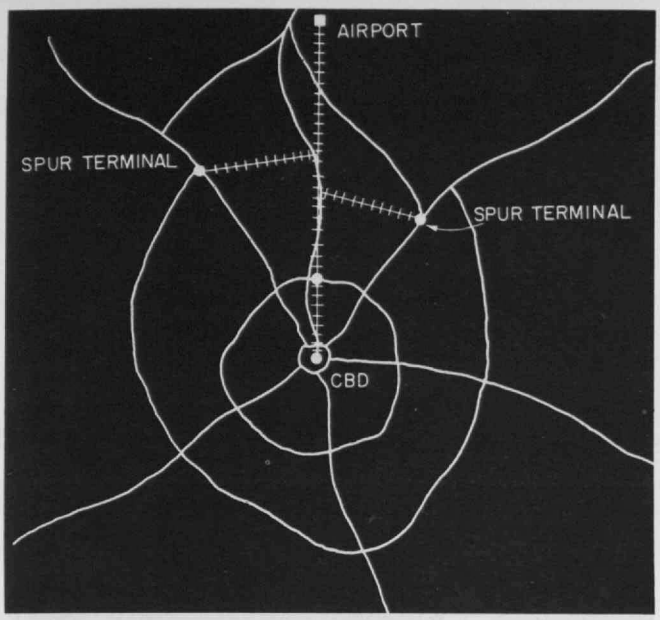
The "first generation" device has been designed and constructed in the Man-Machine Systems Laboratory but has not yet been installed in an automobile. Preliminary evaluation in the laboratory indicates that the design is feasible and with further improvement can provide the means to investigate driver response in emergency situations. At present the display reacts rather sluggishly, particularly when the distance being simulated is small, but Cornell considers that further work is amply justified by initial performance. The system also has possibilities as a driver training instrument or an alertness testing device.

How to Get to the Airport

Transport between a city and its airport is already a source of frustration, and the volume of air passenger traffic is increasing at a rate such that, for example, Dallas, Boston and Miami airports will in 1980 each handle as many travellers as the two New York airports together do at present. Transporting these people to and from the airport is a problem with its own peculiarities, related to the characteristics of air travel itself and to those of the air-going public, who as a class have perhaps not been subjected to as much examination as they merit.

Such was the finding of Allan J. Munds, a British Airports Authority traffic engineer who attended M.I.T.'s Center for Advanced Engineering Study early last year and performed a study on *Ground Access to Major Airports in the United States* (published by the Department of Aeronautics and Astronautics). Airport users are distinguished by high family income (about 2.5 times the national average) and a tendency to own two cars (38 per cent, probably rising to around 60 per cent in the near future). Two thirds of them are travelling on business. Nevertheless the proportion travelling to or from the central business district of a city is only 30 per cent.

Assuming that the maximum annual capacity of a conceivable airport is 30 million (and New York will need at least four such by 1980, Chicago three or four, Los Angeles two or three) and that three-quarters of these go by car or taxi, then each airport requires a six-lane highway for the exclusive use of its passengers and staff. This gives a picture of the volume of the traffic, but not of its topology: origins and destinations (apart from the central-business minority) are widely scattered. Over much of the journey the driver to the airport competes for headway with the rest of the driving public, and as the years go by his journey times become longer



One possible structure of an airport access system which would serve travellers to and from both the suburbs and the central business district (CBD). Costs of right-of-way and construction force the designer to try to maximize the use of the system by a clientele who instinctively prefer the automobile.

and less easily synchronized with the prompt departures of the planes.

Now, the typical air traveller is unaccustomed to using conventional mass-transit systems; also, he is under no serious financial constraint. He wishes to travel quickly and predictably between home, hotel or business and the aircraft, and any assistance he is offered will have to compete with his own instinctive solution, the automobile.

Mr. Munds has considered the problem under two categories, suburban and central business-district. For the former, he examines the possibilities of: buses on public highways; subway or rail links; vertical-take-off aircraft; and such schemes as the M.I.T. automated guideway for road vehicles. For the central-business category: highways (with various degrees of exclusiveness); air-cushioned track vehicles; "duo-mode" systems (in particular the M.I.T. "Glideway" which operates as a high-speed train or as small separate units, as required) and, again, rail transit and vertical-take-off aircraft. And he attempts to find systems which will satisfy the needs of both types of traveller.

In the end he narrows the choice down to four systems, three of which are unconventional. The conventional one is the bus, operating on an exclusive route between airport and central business district, with perhaps two intermediate stops or "spurs" on suburban ring-roads.

The second option is like the first, but with a mechanical guideway to prevent delays in times of bad visibility. And the third is a further refinement on this—a fully automated, electrically powered guideway like the M.I.T. "Metran." Fully automatic steering and speed control allow the highway to be narrow compared with a conventional traffic lane, with considerable advantage to the constructing authority. The fourth scheme to survive Mr. Munds' analysis is the two-mode "Glideway" hovercar/train system, of which the high-speed train mode might come into its own where the airport is at a great distance from the city.

Farming the Sea

In nature, a female shrimp spawns 500,000 to 1,000,000 eggs at a time. These eggs fall to the bottom of the ocean and hatch into larvae within 24 hours, but it is obvious to any casual observer that only a small percentage of these larvae survive to complete the life cycle. Yet this immense potential for reproduction has made shrimp the subject of one of the world's first successful programs to farm the sea.

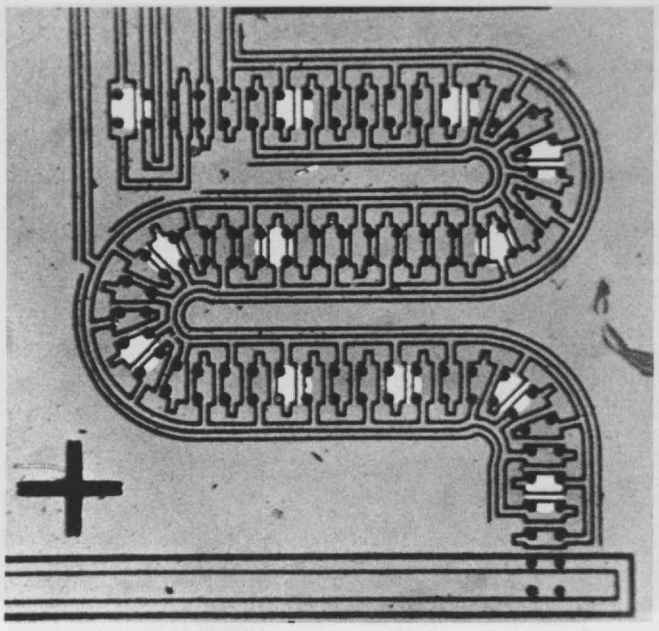
In nature, shrimp larvae have little mobility for three weeks after birth, feeding on microscopic plants which drift within their limited range. Later the maturing shrimp become weak swimmers and journey to bays termed "nursery areas," where they feed on organic detritus, algae, small crustaceans and clams. Six months later the shrimp retrace their paths to the open sea to reach maturity and spawn; within a year the entire cycle is completed.

There are three elements in the cultivation process. Mature female shrimp are induced to spawn in concrete hatching tanks and then immediately removed to prevent cannibalism. The eggs hatch after 14 hours of incubation, and for the first 7 to 12 days the larvae have no reflex to swim toward food, so a natural circulation of first plant and later animal food must be maintained. Twenty days after birth, when the weight of an individual larva is 0.02 grams, the young shrimp are transferred to outdoor ponds; there they are cultivated for seven months to reach the weight of 25 to 35 grams.

One key to successful shrimp farming has been the achievement of a food source which is inexpensive, continuously available in large quantity and nutritious. This source is *Artemia salina* (brine shrimp), a highly nutritious living protein of a size easily consumed. The system is simple: the *Artemia* are placed in the shrimp pond and continue to grow and reproduce until they are consumed—a significant factor in view of the fact that 400 or more are required to feed a single shrimp for one day. Use of a living food source also reduces problems of disease which are associated with uneaten food decaying in the shrimp pond.

Economic comparisons have demonstrated the highly favorable return on an investment in pond construction

Demonstration of how minute magnetic "bubbles," may accomplish counting, switching, memory, and logic functions all within one solid magnetic material. This actual circuit, a photolithographic pattern on the surface of a sheet of thulium orthoferrite, can move magnetic "bubbles" (large white dots) through a shift register. The magnetic bubbles are 4 thousandths of an inch in diameter. (Photo: Bell Telephone Laboratories)



and shrimp culture compared to the return on an equal investment in a shrimp trawler. A $40,000 shrimp trawler may yield up to 50,000 pounds of shrimp per year; but the same capital would build shrimp ponds yielding 40,000 to 80,000 pounds at much lower operating costs.

Other factors also favor the farming approach. The pond owner, who can determine for himself when he markets his product, is less subject to vagaries of the market than the owner of a trawler loaded with a perishable product. Because of seasonal restrictions, vessels can be utilized only for a brief part of the year, and a large investment is necessary to freeze and store shrimp to meet the offseason demand. Government regulation in the interests of conservation limits the type and length of trawlers, hours of operation, type of net, and areas which may be fished.

It now remains for concepts and methods which have proved effective in farming shrimp to be applied successfully in the cultivation of other marine organisms.
—Jerry E. Cook

Switching with Magnetic "Bubbles"

Minute magnetic "bubbles," which may provide compact and inexpensive data storage and switching for computers and telephone systems, are the basis of what Bell Telephone Laboratories call "a new technology" now being explored at Murray Hill, New Jersey.

The goal of low-cost, low-power, all-digital data processing and switching has been before communication and computer engineers for many years. Connections between electronic components are a major factor in costs and power consumption in present computer and communication technology.

The new "bubbles," locally magnetized areas that can be moved about in thin plates of magnetic material, seem to promise a major step toward the goal. As presently developed at Bell Laboratories, the "bubbles" can be created, erased, and moved anywhere in the thin magnetic sheets without interconnection. Moved toward or away from circuit elements in the material, they can make or break connections quickly and with little energy consumption.

The "bubbles" may interact with one another in a controlled fashion, and their presence or absence can be detected. Therefore, Bell Labs engineers anticipate that devices employing the new technology could be made to perform a variety of functions, including logic, memory, switching, and counting—all within one solid magnetic material.

The "bubbles" may be controlled either by programing electric currents in an overlayed pattern of conductors or—with no connecting wires—by controlling the surrounding magnetic field. Thus the energy needed to manipulate the "bubbles" can be applied by current-carrying conductors, or it can be picked up from a surrounding magnetic field by microscopic "ferromagnetic antennae" distributed over the surface of the material in printed patterns. The energy required to move, or switch, such a "bubble" is minute—a fraction of that needed to switch a transistor.

Stepping-stones to the new technology are the orthoferrites, magnetic materials composed of rare-earth iron oxides. When a magnetic field of a critical value is applied to an orthoferrite, "bubbles"—almost perfectly cylindrical magnetic domains—are formed. These can be moved at high speed in the plane of the sheet of the orthoferrite material.

"Bubbles" of a size corresponding to only a few wavelengths of light can be manipulated. These lead to memory densities of about one million bits per square inch, according to Bell Laboratories engineers. As the "bubbles" are moved into precisely defined positions, their presence or absence at different positions can represent binary numbers. One experimental device using the "bubble" technology is a shift register, a component widely used in data transmission equipment and computers for temporary storage of binary digits. Data rates of 3,000,000 bits per second have been demonstrated with this technology. Only a few processing

steps are required to realize its simple structure, and devices of very low cost are anticipated.

Though much work still remains before these devices can be shown to be practical for use in computer or communications systems, Bell Laboratories engineers suggest that their potential for functional adaptibility, physical simplicity, small size, low power, and low cost may open the door to new strategies in systems organization. The conventional random access memory organization does not appear to be a particularly suitable vehicle for the bubble technology; but the fact that logic and memory now appear almost indistinguishable suggests that other organizations may be appropriate, they say. The potential low cost suggests the possibility of new trade-offs between hardware and software.

The work is credited in part to William H. Schockley (M.I.T. Ph.D.'36), Professor of Engineering Science at Stanford University, who is a consultant to Bell Laboratories; E. Michael Gyorgy (M.I.T. '50) of Bell Labs' Inorganic Chemical Research and Development Department; and Alfred A. Thiele (M.I.T. '60) of the Fundamental Memory Components Department.

Can the Farmer Use Heated Water?

It is estimated that by 1985 a quarter of the nation's whole surface water supply will be passing through the heat exchangers of power stations. This being so, it is of interest to discover what use can be made of very large quantities of warm water. The Atomic Energy Commission last year took a hand in drafting a proposal for a warm-water irrigation project, using effluent from a nuclear power station. To date, funds for the $2.6 million scheme have not been found, reports Luther J. Carter (*Science,* Vol. 165, p. 479). But two Oregon utilities have now succeeded in getting under way with waste-heat agriculture experiments, Carter says.

The Eugene Water and Electric Board has invested $475,000 in "demonstrating", with the help of local farmers, that sprinkled warm water can stimulate plant growth and prevent destruction of fruit trees by frost. This scheme is apparently likely to be supported by the Federal Water Pollution Control Administration. And at Oregon State University plants are being grown in soil warmed by buried electric cables—simulating water-pipes—to see if growing seasons and yields can be improved in this way.

It is too early to say whether either experiment will yield any conclusive results. The Eugene scheme has thrown up some interesting observations—early ripening of strawberries, notably—the significance of which has however been seriously questioned by Howard T. Bonnett, associate professor of biology, and others at the University of Oregon. Bonnett also calls attention to the possibility of radioactive contaminants being concentrated somewhere along the plant-animal-man food-chain. A full report of the first year of the three-year study will be available in November, it seems.

The Oregon State University experiment, supported by Pacific Power and Light Company, so far indicates that corn and string beans can be stimulated by underground heating, but alfalfa, soybeans and lima beans have not benefitted from this treatment.

As Carter points out, "not much is known scientifically about how crops respond to warm water under actual field conditions, nor can one predict yet how warm water will affect insects and plant disease organisms." A.E.C. chairman Glenn T. Seaborg, who is in favor of the Eugene project and has appeared in a film about it put out by the Oregon State Department of Economic Development, frequently stresses that "there is no need for hysteria" over thermal pollution, since (in the words of a paper he gave at the Argonne National Laboratory this year) "we have barely begun to tap the scientific and technological ingenuity that can solve this problem."

A Magnet in the Brain

The first human tests of a system which uses external magnetic energy to direct a small metal pellet through the tortuous blood vessels of the brain were reported at the Third International Biophysics Congress held at M.I.T. this summer, by D. Bruce Montgomery and several colleagues at the Francis Bitter National Magnet Laboratory and the Massachusetts General Hospital.

The device had been previously tested on laboratory animals (*see* Technology Review *for February, 1969, page 59*), and this summer it was used to deliver chemotherapy agents to otherwise inaccessible brain areas in four M.G.H. patients with terminal brain tumors.

The concept is simple: a small magnetic pellet inserted into the intracranial artery is guided through blood vessels in the brain by two external magnets whose alternating fields are rotatable in all directions. Interplay between the two fields causes the pellet—whose position is monitored by X-ray equipment—to oscillate slightly, resulting in a motion that Dr. Montgomery describes as "dancing through the blood vessel."

Dr. Montgomery and his colleagues—N. T. Pierce and J. Richard Hale of the Bitter Magnet Laboratory and Dr. S. B. Yodh of Massachusetts General Hospital—believe the device will be useful in at least four ways:

1. To make possible localized injection of pharmaceuticals into the brain. (It was this for which the system was first used this summer, Dr. Montgomery said.)
2. To diagnose the presence of tumors and other obstructions in the brain's circulatory system by measuring blood pressure and flow.
3. To inject fluids opaque to X-rays into specific areas of the brain in order to make possible X-ray diagnosis of brain damage.
4. To perform critical surgical procedures deep within the brain. For example, said Dr. Montgomery, an in-

flatable tip on the pellet would give it the power to close off blood circulation at a critical point in a blood vessel.

Reporting the new development, the *Boston Globe* said that "perhaps the major technical achievement is the precision with which the (brain catheter) can be guided through the brain's tiny vessels without rupturing their walls."

Further testing and development is necessary before the system is ready for general clinical application, Dr. Montgomery emphasized.

Computer Sorts Five Kinds of White Cells

The combination of a computer with an unusual electro-optical color scanner, has made possible the automatic counting of white blood cells against the background of red cells. The technique, developed by Murray Eden, Professor of Electrical Engineering, and Ian T. Young (now Assistant Professor), both of M.I.T.'s Research Laboratory of Electronics, can also identify the five principal types of white blood cells by spotting differences in color, shape, and texture.

The method should replace the current manual system of determining variation from the norm in the number of each kind of white cell, needed in diagnostic tests for infections, allergies, leukemia, typhoid fever, and certain types of poisoning. Manual counting is estimated to cost about $200 million annually.

In the automatic technique, the typical sizes, textures, and colors of the nuclei and cytoplasm of the different types of cells are first stored in the computer, as a basis for comparison with diagnostic samples. In general, the recognition and counting process closely resembles what a human technician does.

The color optical scanner was developed by Dr. Oleh Tretiak, lecturer at M.I.T., in 1965. First, a color slide of the uncounted cells is made. A scanning spot of light on a cathode ray screen is imaged on to the slide, positioned about a foot from the screen. The emerging light, carrying the color of each point on the slide in turn, strikes a set of "dichroic mirrors" (which transmit certain light frequencies and reflect others). The mirrors separate the light into three basic wavebands— red, blue, and green; the computer memory can distinguish 63 different intensities of each color. Each point of colored light is thus assigned a set of three intensity values. Across the whole cell, the numbers are combined into a histogram which represents its overall color.

Following this operation, the computer traces out the nucleus boundary and outer perimeter of the cell. This much of the process derives from a well-established technique of finding successive adjacent points of constant intensity in the computer's image of the cell, and recording the form of the path thus traced out.

So far the technique is 95 per cent successful in locating white cells against the background of red cells and platelets, and 90 per cent accurate in sorting the cells into five types. Perhaps not surprisingly—in view of the resemblance between the color-scanning technique and human color vision—the system is said to make the same kinds of errors as a human being does. If developed, the computer method would be faster, more accurate, and less expensive than manual techniques. And plans call for the further advance of connecting the computer directly to the microscope, cutting out the color-slide step.

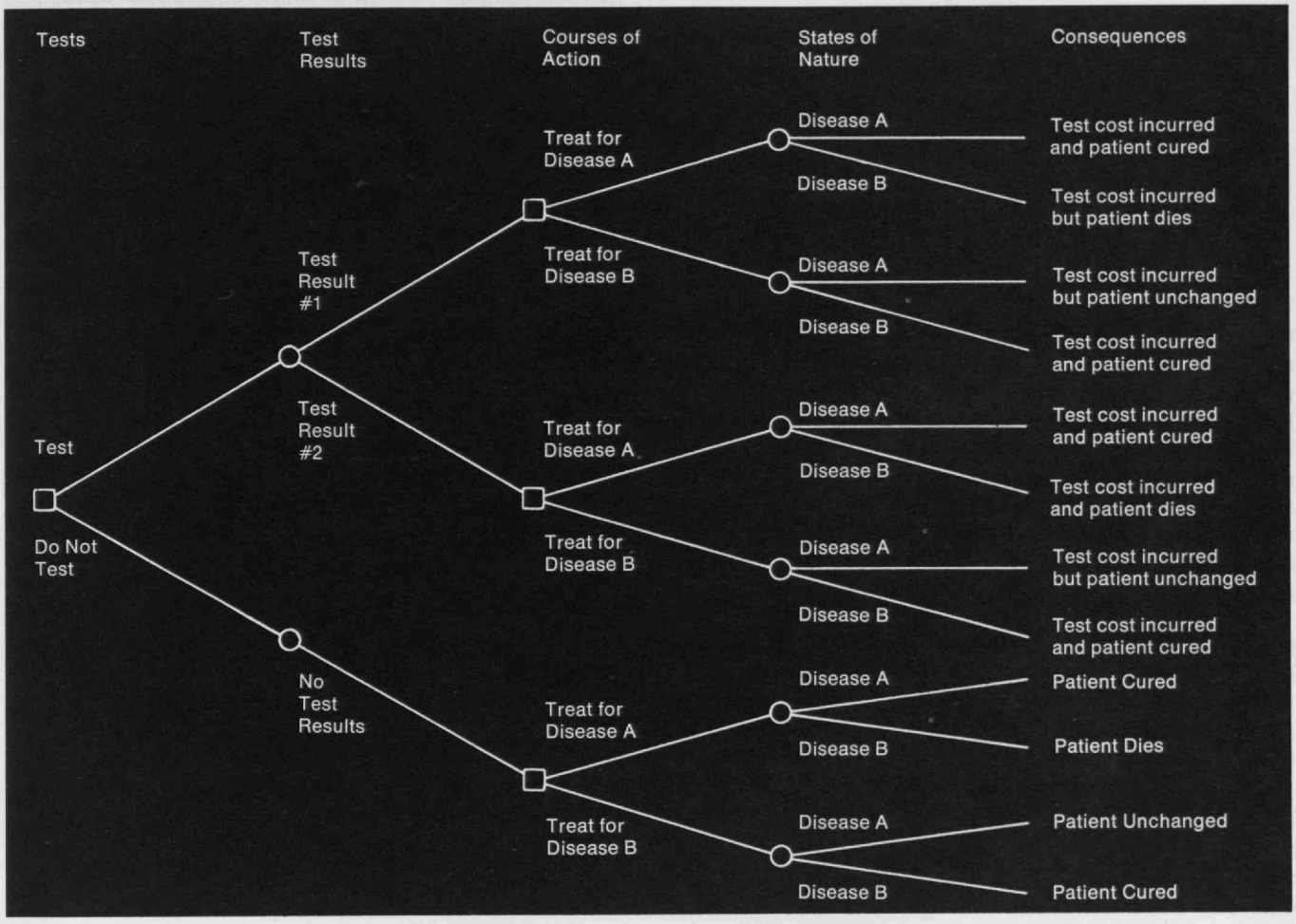
Doctor's Dilemmas Are More Difficult

The shortage of doctors, aggravated by the rapid expansion of medical knowledge which makes it difficult for a doctor to keep up with developments, has led to interest in the use of computers in medical diagnosis and treatment. The computer's ability to store and retrieve huge amounts of information would seem to make it a valuable tool—ideally the computer would be able to offer a specialist's knowledge of a disease.

The main problem in modeling diagnosis and treatment is that the decisions of a doctor involve qualitative factors, such as "intuition", and the situation being diagnosed contains unknowns. The physician cannot be certain of the consequences of a particular action in a particular case; and the desirability or otherwise of the various possible consequences is decided subjectively. Norman E. Betaque, Jr., an M.I.T. graduate student, has attacked the problem of quantifying the myriad preferences and judgements available to the doctor in a treatment situation, using "utility theory" (also known as decision analysis or statistical decision theory).

In constructing a computer model of the diagnosis and treatment of acute renal failure, Betaque worked with doctors, who subjectively assessed the "conditional probabilities." Probabilities were established in three areas: *a priori* probabilities of the possible diseases; in a given patient, the probabilities of particular test results, for each disease; and probabilities of the con-

The "decision tree" which maps the possibilities inherent in the process of diagnosis and treatment.



sequences of particular treatments, when applied to each disease. The doctors also assessed "utilities"—that is, desirabilities—for tests, treatments and outcomes on the basis of human and financial considerations.

Betaque and the doctors encountered their greatest difficulty in assessing the utilities of consequences, and in bringing them into the same dimension as utilities of tests and treatments. Not surprisingly, although considerable thought and ingenuity were devoted to attempts to bring a doctor's values into a single numerical scale, no entirely satisfying solution emerged.

Nonetheless, the model in fact came close to imitating each doctor's values. It performed very much like the doctor on 28 hypothetical cases. The model's preferences for tests and treatments agreed with those of "Doctor No. 1" on 25 of the 28 hypothetical cases. When a second doctor established his own scale of values, the model and the doctor reached the same conclusions 26 out of 28 times. Two additional cases of disagreement between the model and Dr. No 2 were traced to the fact that the model was still using Dr. No. 1's probabilities.

But, even with 90 per cent accuracy, the model is not ready to begin practicing medicine; the diagnostic situation in which it performed was a highly simplified one. Betaque believes, however, that enlargement of the model to include a greater number of conditions and probabilities is entirely practical. "Utility theory" seems to be a workable approach to making a computer model of the work of, any rate, a given physician.

Negative Aspect of Medical Technology

The 22nd World Health Assembly, held this year in Boston, was noted primarily for political disagreements, which—given the composition of the World Health Organization—were almost inevitable. A more fundamental issue, raised during the technical sessions, passed with little or no public comment. The technical sessions were devoted to "the application of evolving technology to meet the health needs of people." And the question was raised as to whether, as far as the needs of the generality of people are concerned, medical technology has not already evolved farther than is useful.

Discussion of this theme was started by Dr. P. D. Martínez, Mexico's Under-Secretary of Health and Social Welfare. New technology, he said, has a negative aspect. The specialists in the new medical techniques tend to apply them only to a fortunate minority.

The user of the latest equipment readily becomes preoccupied with it, and judges himself by the impression he creates within the circle of those similarly equipped ("even in the United States, I gather," said the Mexican delegate). The result is a weakening of his humanitarian concern with the relatively basic health needs of the people outside the reach of an advanced medical center. The more technology, the less likely the specialist is to adapt himself to the society around him.

The chairman—Dr. G. A. Novgorodcev of the U.S.S.R.—at this point asked delegates to adhere to the agenda, which related to organizational means of facilitating the introduction of new technology, to the content of training programs, and to the funding and role of training and research institutes. But Dr. Walter Ravenna, Uruguay's Minister of Public Health, immediately expressed his agreement with Dr. Martínez. Any practitioner wishing to acquire advanced medical techniques can do so without great difficulty, he said. But in the less developed countries the most severe problems relate to housing, water supply, sanitation—problems which do not call for highly sophisticated solutions. Personnel who are trained to a more advanced level than is generally needed either emigrate or stay in institutions which cater for the fortunate minority.

In spite of the chairman's frequent appeals on behalf of the agenda, a considerable body of support for Dr. Martínez's point of view emerged. As regards the problem of the clustering tendencies of the highly trained, a number of delegates spoke of the need to persuade trained physicians to get away from the urban centers and into the rural regions where they are really needed. In Chile, according to the Minister of Public Health, Professor J. M. Ugarte, 90 per cent of the M.D.'s are in cities of greater than 15,000 population, whereas over half the people live in small towns of less than 5000. Newly graduated physicians are legally required to leave the capital, he said. And on the subject of the ease with which underdeveloped countries can obtain technology which they don't really require, Dr. S.P.W. Street, of Jamaica, said "If technology is going to mean anything, it must not waste money." Jamaica is establishing standards of usefulness and maintainability for novel imported medical equipment.

The New Graduate and the Organization

One of the ways in which dissention among students presents a real problem is that today's student is—in principle—tomorrow's recruit to industry and management. Edgar H. Schein, Undergraduate Planning Professor in M.I.T.'s Sloan School of Management, has studied current student attitudes and attempted to advise organizations on how they can respond in their own best interests.

In a paper delivered this year, in different forms, to the American Management Association and to an M.I.T. symposium, he said: "If the young of today are disillusioned, impatient, action-oriented, and prepared to get deeply personally involved on behalf of strong ideals . . . one simple alternative is to say that these are youthful foibles which will go away after a while. 'When the kids grow up a little more they will settle down'."

"While the growing up is supposed to occur, the organization is, of course, busily teaching its value system to its new employees." The recruit can respond to this situation in three ways: conformity, rebellion or "creative individualism". The last consists in accepting the basic goals of the organization "while rejecting those traditions and norms which are not crucial."

The trouble with adopting the "let's wait while they grow up" attitude, says Professor Schein, is that in this way we are more likely to elicit conformity or rebellion than creative individualism, which is in fact the most useful attitude. "We have let stifling practices creep in while extolling the virtues of our dynamic organizations. The young see this more clearly than we can, and we would do well to pay attention to what they tell us."

As an example of a mutually profitable relationship with young people, Professor Schein recalls "one of the most successful seminars I every had in the Sloan School." It was in a field where his own knowledge was

limited, and he admitted this to the students; he then "parcelled out the uncharted territory among four student teams," and left them to do the research in the knowledge that, if they did a poor job, "I would never know." Shared shortcomings are more effective than a pretended omniscience, it seems.

"You may be interested to know," says Professor Schein, "that some of our graduates are reading recruiting ads with the following filter: they assume that the company's weak spot is that which they emphasize in the ad. If the ads emphasize challenging careers and a 'small company atmosphere', they assume that the organization's major problem is the inability to achieve these two things. I have tried reading ads with this filter and have come up with some fascinating hypotheses about some of our large corporations." Friends in "the placement and recruiting business" have found in recent years that telling the truth about an organization is more effective than the traditional sales pitch.

The Computer as Proprietor

In spite of the decision by the U.S. Court of Customs and Patent Appeals, in August, implying that computer programs can be patented, many patent experts still consider that software patents are not practicable. Early this year, patent examiner T. Buckman described the position of the Patent Office on this question as "an effort to safeguard the patent system from the deleterious effects of blanket protection for an illusive, undefined article of commerce, i.e. programs." These effects extended to the possible "demise of an effective patent system." Buckman laid the onus on the protection-minded programmers to define rigorously just what it was they wanted (*Journal of the Patent Office Society,* Vol. 51, No. 3). The present trend seems to be towards some form of copyright for programs, but it is doubtful whether any real protection can be conferred in this way. Buckman tentatively suggests an intermediate system.

It will be ironic, then, if computer systems themselves succeed in becoming patent and copyright proprietors. In a later issue of the same journal (Vol. 51, No. 6) Karl F. Milde, Jr., concludes that "the issue of whether the writings and discoveries of a computer should be granted copyright and patent protection is an urgent one for Congress."

So far, says Milde, this question has simply been overlooked. "The closest that the Patent Statute comes to requiring that a patentee be an actual person is in the use, in Section 101, of the term 'whoever'." The question of whether an inventor or author has to be human to be granted a patent or copyright, if it is not settled by Congress, will have to be decided by the courts as cases arise—which will not be long hence, Milde considers. Decisions under the common law of unfair competition rest on the question of whether "what has been done *could* have received protection under the patent and copyright laws," Milde points out; and the time is rapidly approaching when the disputed novelty could have originated in a computer system.

Of course, this raises the philosophical problem of whether a machine can perform original creative work in the same sense in which a human being can. Milde's view is that, for practical purposes, decisions made by a computer can be as unpredictable as those made by, say, a judge—provided that an observer is unable to discover what calculation function the machine is using to operate on a particular input. In principle, both the computer and the human brain operate according to knowable laws. "Free will" is a concept which can as well be applied to the actual behavior of the one as of the other.

Milde examines the constitutional requirements for patent protection, and finds that an invention originating in a computer system should be able to pass all of them. (Thomas Edison, he reminds us, discovered a good material for electric light filaments by trying one material after another—a process for which computers are particularly well adapted.) As regards copyright, anyone wishing a court to agree that a machine was the author of a particular composition would find that his greatest difficulty lay in proving originality. Milde describes a hypothetical music-writing system, capable of being educated by the progressive human criticism of its works; such a system might well produce commercially valuable music, and would become hard to distinguish, in point of originality, from a human composer.

The current version of MacHack, M.I.T.'s chess-playing computer, is an honorary member of the U.S. Chess Federation and of the Massachusetts State Chess Association, and holds three trophies.

The opening ceremonies for the Third International Biophysics Congress brought distinction to the Kresge Auditorium stage. The picture shows Arne Engstrom, Honorary Vice President of the Union; Arthur K. Solomon, Secretary General of the International Union for Pure and Applied Biophysics; Walter A. Rosenblith, chairman of the organizing committee; Aharon Katchalsky, President of the International Union; Philip Handler, President of the National Academy of Sciences; and Howard W. Johnson, President of M.I.T., listening to the address of Detlev W. Bronk, President Emeritus of Rockefeller University, who was Honorary President of the Congress.

Police Technology: the Alternative

As George Boehm has revealed ("Fighting Today's Crime with Yesterday's Technology" in *Technology Review* for December, 1968, pp. 50-59) many of the nation's police forces are working with extremely outdated and inadequate methods for finding and apprehending criminals. He noted that the police were only partly to blame, because "until recently they have had almost no support to modernize their work." This observation is borne out by Gerald L. Hallworth, Assistant Professor of Government at St. Mary's University, San Antonio, Texas, who writes in *Trial* (Vol. 5, No. 4):

"Our cities have scarcely hesitated to appropriate money along the general lines of 'more bang for the buck'. They have allotted funds for armored cars, additional shotgun and rifle firepower, and other deadly weapons so that the police can wage the 'war on crime'. Yet these same legislative units have refused to appropriate money for 'voice-print' devices, computer employment, or equipment that would update local scientific laboratories—all invaluable for crime detection and crime solution when deployed imaginatively."

As the crime rate rises, the crime-solution rate does not (in August the annual FBI "Uniform Crime Reports" showed that in 1968 serious crimes increased by 17 per cent over 1967, while the solution rate fell 7 per cent). And, according to Professor Hallworth, inadequate police technology has another consequence. Hitherto, public prosecutors have relied heavily on confessions. As a result, police "concentrate on making a suspect speak and not on having the things of the crime do the talking. Many times police departments fail to explore adequately the scene of the crime and sometimes, in fact, crime scenes are obliterated by police activity."

Referring to a recent Supreme Court decision (*Miranda v. Arizona*) to the effect that the state must demonstrate that a confession is voluntary, Professor Hallworth comments that it has caused police officers to "fear that they are in danger of losing what is perhaps their major police technique in crime solution." What the decision implies, he says, is that police departments must begin to place more emphasis on "making the *things* of the crime scene speak." And this in turn requires investment in new technology, and in training policemen to use it. In fact, most police departments are already aware of these needs, Professor Hallworth considers, "but far too often, the police request for money falls on the deaf ears of our local legislatures."

Science Alone is Not Enough

The world's biophysicists are a young, elite fraternity. But when their Third International Congress convened at M.I.T. this summer, it became clear that they demonstrate—in microcosm—the same evolutionary development through which every scientific discipline has passed.

Classical biophysics, said Aharon Katchalsky of the Weizmann Institute of Science, began with simple applications of physical tools—such as the electron microscope—to the study of living things. Now it has progressed to the modern effort to "create a conceptual structure which enables us to integrate biological phenomena into a unified physical system," he told the opening session of the Third International Biophysics Congress.

From this systemic view, biophysicists during the 1969 Congress progressed one step further—to a preliminary expression of their concern for the social consequences of their work. At an open meeting during the Congress, more than 60 of its participants urged the International Union of Pure and Applied Biophysics "to include in all future meetings an official colloquium for the discussion of social problems arising from the biological sciences."

It was a sticky question, as Walter A. Rosenblith, M.I.T. Associate Provost who was Chairman of the 1969 Congress Organizing Committee, pointed out: I.U.P.A.B. is composed of a number of national committees and therefore cannot take official action in the political realm. But the council of I.U.P.A.B. agreed to take up the question at its next meeting.

Philip Handler, President of the National Academy of

Sciences, told the biophysicists at their opening session that "science alone is not enough—but without it nothing else is possible." But the *Boston Globe* reminded the biophysicists that the only way "to right the wrongs they have seen in our society is through the political process."

Dust of the Ground

Protein molecules are often pictured as strings of beads, each "bead" being an amino acid. But exactly how natural forces have strung the amino acids together in particular sequences—and thus created the structural basis of life on earth—has long eluded scientists.

Almost two decades ago, Nobel Laureate Harold Urey and colleagues demonstrated in the laboratory that amino acids may be formed by irradiating chemicals believed to have constituted the primeval atmosphere of the earth. In the early 1940's, the English scientist J. D. Bernal theorized that these amino acids could not have condensed into protein molecules in an oceanic environment. The ocean was simply too vast and diffuse to assist in such an intricate crystallization process. Bernal suggested that the linking must have occurred in denser materials, such as clay. At the Third International Biophysics Congress, held at M.I.T. in September, an Israeli scientist revealed new experimental data suggesting that clay indeed played a key role in the origin of life.

Professor Aharon Katchalsky of Israel's Weitzmann Institute of Science (and President of the Biophysics Congress's sponsoring body, the International Union for Pure and Applied Biophysics) began by explaining that his research group had tried for some time, unsuccessfully, to link chemically reactive amino acids into protein chains. Initially, they attempted this in a laboratory environment in which presumed early oceanic conditions were duplicated—room temperature, and an acidity roughly that of the human body and of the ocean. The results were poor—until montmorillonite, a type of clay found in many common soils, was added.

The products of these experiments were protein chains in a primitive form. Dr. Katchalsky theorizes that such chains are missing pre-biologic links between amino acids and the more sophisticated and complex proteins found in life forms today. The Israeli research team also evolved thermodynamic equations which described aspects of this bead-stringing—or polymerization—process in terms of energy flows.

The application of the equations of physics to the study of life's origins was an unusual aspect of the Third International Biophysics Congress. Quantitative models describing several facets of life formation were presented at the Congress by Professors Illya Prigogine of Belgium's Université Libre de Bruxelles, Harold Morowitz of Yale, Howard Patee of Stanford, and Vzastimil Liebl of the Czechoslovakian Academy of Sciences. And Dr. C. T. Caskey of the Laboratory of Molecular Genetics at the National Heart Institute told the Congress that computer-assisted studies give no evidence of any primitive, precursor genetic code anywhere on earth. Any change of which we can conceive, he said, "alters the entire genetic system on this planet." Indeed, data are "grossly lacking," he declared, for any model of the evolution of the genetic code as we know it.

A co-chairman of a key symposium on "Thermodynamics and the Origin of Life," Professor Cornelius Tobias of the University of California, Berkeley, described the significance of these presentations:

"There are now several approaches which might allow us to make a quantitative, theoretical model which might predict such things as the rate of new synthesis of organic molecules, the polymerization of amino acids to protein-like molecules, or the type of oscillations which organelles in the cells exhibit. Five years ago, we didn't have any idea how to approach such complicated processes quantitatively. With such equations, perhaps we can design fundamental experiments to yield more data on the origins of life."—*William K. Stuckey*

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Adding 40 Yards

To the Editor:
The article by Prof. B. L. Averbach entitled "Progress on the Number One Wood" in the May issue of the *Technology Review* has caused quite a lot of interest amongst my fellow golfers and we have the following comment: —

The test did not go far enough—had the ball been allowed free flight, and the distance achieved measured, the following answer to the final question, "how can I add 20 yards to my drive?," would have been confirmed.

Study of the ball hit by the professional shows, by movement of the word "titleist," that the ball has slight backspin. Similar study of the ball hit by the amateur shows that not only has it more backspin, but it also has a clockwise rotation about an axis along the line of flight; in other words, it has "fade". Reduce the backspin and eliminate the fade, and the extra twenty yards will come easily.

Prof. Averbach's reply would be of great interest—doubtless by now he has reduced his handicap. I trust that he will remember the old golfing adage "drive for show and putt for dough".

E. Klein
Johannesburg

Professor Averbach comments as follows:

The fade spin in the test shots was noted, and corrective action was started with the aid of Tex McReynolds. The multiflash photographs show that there is a considerable loss in ball velocity if the club face is significantly open or closed just prior to impact. This loss may be caused by the dissipation of some energy into the spin of the ball, but it is probably an indication that the swing is faulty.

Recently, I have been able to evaluate the experimental clubs on a practice tee which had distance markers located by a surveyor. Exact lengths were not measured, but a grouping of 25 drives with my best club (aluminum shaft, steel insert, swing weight D-1) was about 20 yards beyond the group with my old club. There was some overlap in the two groupings, but the ten longest drives came from the new club. A few friends with various handicaps have also tested this club against their favorites, and they seem to verify these results. There are still other features of club construction which can influence the performance, and I am now happily engaged in a new investigation.

I must sadly agree with the validity of your comment on putting. But yet, if I could add another 40 yards to my drive. . . . . .

A Dismaying Revision

To the Editor:
Having studied civil engineering 51 years ago, I thought it was about time I learned something about metallurgy. In my first lesson I learned that unlike European metal work which usually utilizes only the fluidity and workability of metals, Japanese metal work often reveals a deep feeling for the structure of metals and their chemical properties.

This was so intriguing that I wanted to read the rest of the book from which it had been quoted. Noting the instructions which read, "The first letters of the definitions give the author and title from which the quotation is taken," I arranged those 28 first letters in alphabetical order AAAAAABCCDEKLLLLLMMNOPPSSSUW and tried to unscramble the anagram. I was immediately frustrated by the lack of E and T, the most frequent letters in our language and indispensable for a title of a book about mETals.

Then a hunch paid off. For 25 years (1940-1965) I contributed a problem every month to *Civil Engineering.* Nearly every month there was at least one typographical error or dismaying editorial revision. I had noticed one in this Tech-Crostic: definition D referred me to Z instead of Z_1. Sure enough, instead of "The first letters of the definitions. . . ." the test should have been "The first letters of the defined words. . . ." As you probably know, these read SMITH A HISTORY OF METALLOGRAPHY

Maybe the editor made the mistake on purpose—to make the solution more difficult. Anyway, it was a well-contrived problem, skillfully executed—to anagram 170 letters into exactly 28 words with 28 imposed initial letters.

R. Robinson Rowe
Naubinway, Michigan

M.I.T. and National Defense II

To the Editor:
I believe it is appropriate for me to apologize for the tone of my letter published in *Technology Review* for June (*page 75*) and the lack of faith it showed in the Institute. I was misled by the reporting in the *New York Times* of M.I.T.'s decision to temporarily suspend new programs at the two laboratories and I suppose was hypersensitized by recent activities at some of the major campuses throughout the country. In any event, it seems clear that the Pounds Committee (*see* Technology Review *for June, pages 72A-72D*) has done an able, responsible and conscientious job and are entitled to congratulations, as is M.I.T. for appointing them.

Harry G. Parke
Brooklyn, N.Y.

Tech-Crostic Solution

The correct solution to the Tech-Crostic appearing on pages 94-95 of this issue is:

"Evidence that the body can synthesize proteins is quite conclusive. For example, an animal survives well when fed only amino acids and no whole protein, and if isotopically labelled these amino acids can be found in body proteins."
—M. W. Neil, *Vertebrate Biochemistry*

Matrices and a Monkey's Uncle

Hi. My name is Allan Gottlieb, and I shall once again in 1969-70 have the pleasure of editing "Puzzle Corner" for *Technology Review*. Each month from among submitted problems five will be selected for inclusion in the column. Three issues later answers—as submitted by readers—will appear. Easier "speed problems" remain unanswered. This column depends upon outside support. When no problems are submitted, I can—reluctantly—supply some. Unfortunately, my creations are generally inferior to yours, so keep them coming. When you submit answers, please refer to the problems *by number;* don't just select a few words from the first sentence of the problem to identify the puzzle you've worked on. For nearly each issue I find such "title" solutions, and often—after an unsuccessful search for the problems to which they apply—the solutions are filed . . . for good. Currently I have a rather large backlog of submitted problems, so don't be discouraged if your creation does not make an early appearance. Your patience shall be rewarded . . . as shall neat handwriting. Now for the fun:

Problems

1 Smith D. Turner would like you to obtain rational factors of $x^8 - 4x^4y^4 + 16y^8$

Our second problem comes from Edward J. Dudewicz, Assistant Professor of Statistics at the University of Rochester; it concerns positive semi-definite matrices:

2 For the real symmetric matrix Q, let $\Delta = \det(Q)$ and $\Delta_0 = 1$. Let Δ_{n-t} be the determinant of Q with its last t rows and columns deleted. It is well known that Q is positive semi-definite if all principal minors of Q are ≥ 0 and $\Delta = 0$. Is this last condition equivalent to some (seemingly weaker) condition? (For example, one might conjecture a condition such as "$\Delta_0, \Delta_1, \ldots, \Delta_n \geq 0$ and $\Delta = 0$," which involves only the leading principal minors. This, though, is clearly insufficient.) Such a weaker condition could be of use in determining whether a matrix is PSD, especially if it uses little more than $\Delta_0, \Delta_1, \ldots, \Delta_n$.

Number three is from a close friend but terrible first baseman (I was shortstop behind him on the M.I.T. Baker House team), John P. Rudy; he says it is "the bridge hand you've been waiting for, played correctly by Harold S. Vanderbilt in 1929:"

3 The contract is six spades, and the opening lead is ♦3. Play to make it.

North
♠ A K 8
♥ —
♦ A K 8 6
♣ A K J 10 8 2

West
♠ Q 9
♥ K J 10 6 2
♦ Q 7 4 3
♣ 7 5

East
♠ J 6 3
♥ 8
♦ J 10 9 4 2
♣ Q 9 6 4

South
♠ 10 7 5 4 2
♥ A Q 9 7 5 4 3
♦ —
♣ 3

This one is from John C. Maier:

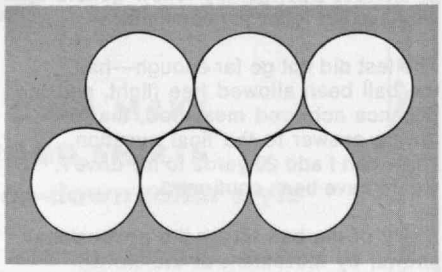
4 A monkey and his uncle are suspended at equal distances from the floor at opposite ends of a rope which passes through a pulley. The rope weighs four ounces per foot. The weight of the monkey in pounds equals the age of the monkey's uncle in years. The age of the uncle plus that of the monkey equals four years. The uncle is twice as old as the monkey was when the uncle was half as old as the monkey will be when the monkey is three times as old as the uncle was when the uncle was three times as old as the monkey. The weight of the rope plus the weight of the monkey's uncle is one-half again as much as the difference between the weight of the monkey and that of the uncle plus the weight of the monkey. How long is the rope? How old is the monkey?

Our last problem is from J. Karl Justin. I am not sure I understand it, but perhaps the readers will do better.

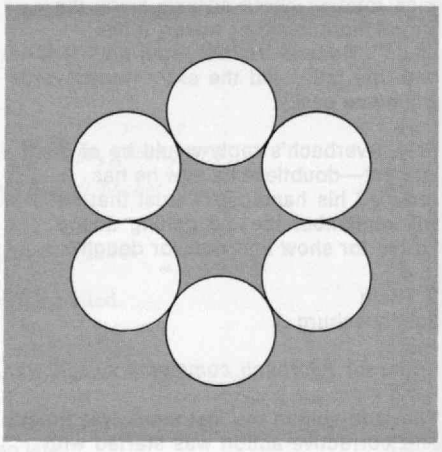
5 Three thespians came on a cache of bright, shining obols and decided to share it. Silimon took some coins, and Stupidas also helped himself. What is the probability that at most one-third of the coins were left for Preposteros?

Speed Department

SD1 Russell A. Nahigian wants you to start with six coins arranged as below:



Then, making two moves such that after each move coin always touches two others, arrive at the following:



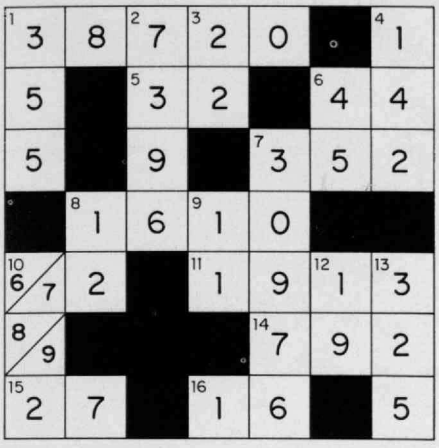
SD2 This is a little tough for a speed problem, so take five minutes and help Frank Rubin find nine points in the plane such that 10 straight lines pass through exactly three of them and no points are colinear.

Solutions

This month we publish solutions to problems which appeared in the May issue. June solutions and a backlog of material on earlier problems next month.

31 Although this puzzle relates to a farmer, his family, and his land, it involves a good deal of engineering mathe-

matics and logic. The problem is to find the age of Mrs. Grooby, Farmer Dunk's mother-in-law, and you must not assume the puzzle was invented this year. You'll need to know that there are 20 English shillings to the pound sterling, that an acre is 4,840 square yards, and that a rod is a quarter of an acre. Also, these hints help: One number in the puzzle is the area of Dog's Mead in rods, but it relates to something in the puzzle quite different from that area. Here's the puzzle.



Across

1. Area of Dog's Mead in square yards.
5. Age of Farmer Dunk's daughter, Martha.
6. The difference between the length and breadth of Dog's Mead in yards.
7. Number of rods in Dog's Mead times number nine down.
8. The year when Little Piggly came into occupation by the Dunk family.
10. Farmer Dunk's age.
11. The year Farmer Dunk's youngest child, Mary, was born.
14. Perimeter of Dog's Mead in yards.
15. The cube of Farmer Dunk's walking speed in miles per hour.
16. Number fifteen across minus number nine down.

Down

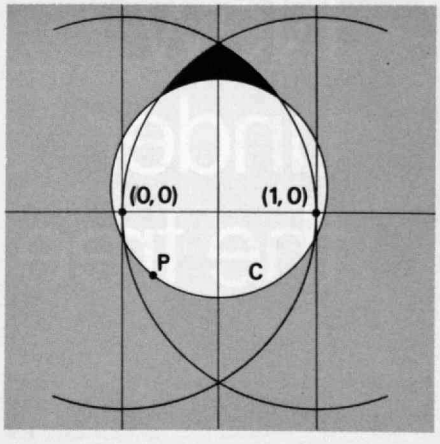
1. The value of Dog's Mead in shillings per acre.
2. The square of Mrs. Grooby's age.
3. The age of Mary.
4. The value of Dog's Mead in pounds sterling.
6. The age of Farmer Dunk's first-born, Edward, who will be twice as old as Mary next year.
7. The square, in yards, of the breadth of Dog's Mead.
8. The number of minutes Farmer Dunk needs to walk one and one-third times around Dog's Mead.
9. See number ten down.
10. Ten across times nine down.
12. One more than the sum of the digits in the second column down.
13. Length of tenure, in years, of Little Piggly by the Dunk family.

The following is from Lawrence S. Kalman:
15A (across): The walking speed must be either 3 or 4 mi./h., the only two numbers with two-digit cubes.
11A:The year must start with digit 1; so 9D = x1 (x is an unknown digit).
Try 4 mi./h.: 15A is 64, 10D is xx6, 10A = 10D/9D = xx6/x1 = x6; 8D is 16 (since 8A is also a year). Now, Farmer Dunk walks 4 mi./h. = 117 1/3 yards/min.; in 16 min. he walks 1877 1/3 yards = 1 1/3 perimeter: so the perimeter of Dog's Mead is 1408 yards. But 14A

Rods	*Sq. Yds.*	*Length*	*Breadth*	*Difference*	*Remarks*
32	38720	220	176	44	Only solution
31	37510	239 +	157 −		Not integers
30	36300	251 +	145 −		Difference > 99; so any area < 30 rods

states that the perimeter is a three-digit number, so 4 mi./h. cannot be correct.
Try 3 mi./h.: 15A is 27, 10D is xx2, 10A is x2, and 8D is 12. Now Farmer Dunk walks 3 mi./h. = 88 yards/min.; in 12 min. he walks 1056 yards and the perimeter of Dog's Mead is 792 yards (14A).
Now, if Dog's Mead were square (it isn't: the difference in dimensions must be at least 10 yards), the area would be a maximum of $198^2 = 39204$ sq. yards. Try the integral number of rods = 39204 sq. yards. (See results above.)
So 1A is 38720, 6A is 44, 12D is 8 + 1 + 2 + 7 + 1 = 19, and 7D is 30976 (italicized digits have previously been determined).
Now 7A is 32 × 9D = 32 × x1 = 3x2; so 9D is 11, 7A is 352, and 16A is 27 − 11 = 16. The only solution for 300 ≤ 1D ≤ 399 and 4D = x42 is 1D = 355 s. = £ 17.75 per acre; the area is 8A; 4D = £ 142.
Since Edward (6D) is 45, Mary (3D) is 22, and Martha (the middle child) is 32 or 42 (5A), so 2D ≥ 7300 and ≤ 7499. Therefore 2D is 7396, the only square in this range, and Mrs. Grooby is 86. Also Martha (5A) is 32 (also the number of rods, as per hint).
Now, Little Piggly came into occupation by the Dunk Family in 1610 (8A). Mary was born in 191x (11A); therefore, the current year is in the 1930's or 1940's. Therefore 13D is 32x, 11A is 1913, the current year is 1935, and 13D is 325.
That leaves only Farmer Dunk's age to be determined. His age (10A) ends in 2; 52 would make him 7 years old when Edward was born (impossible, we assume); 82 would make 10D = 82 × 11 = 902, but the first digit must be an 8 so this is impossible. However, either 10A is 62 and 10D is 682, or 10A is 72 and 10D is 792 are valid solutions, although we admit that the former solution is unlikely.

Also solved by Alan Baum, Robert A. Bender, James M. Field, William T. Frangos, P. Richard Jones, Thomas P. Kennedy, John F. Mandl, Norman D. Megil, Fram C. Minshew, Victor J. Newton, Ed Reed, Frank Rubin, John R. Schaeffer, Sudarshan P. Singh, Smith D. Turner, and Samuel S. Wagstaff, Jr.



32 Let $p_1, p_2, \ldots, p_n$ be points in the plane such that distance $(p_i, p_j) \leq 1$ for $1 \leq i \leq j \leq n$. Prove that these points lie within a circle of radius $1/3\sqrt{3}$.

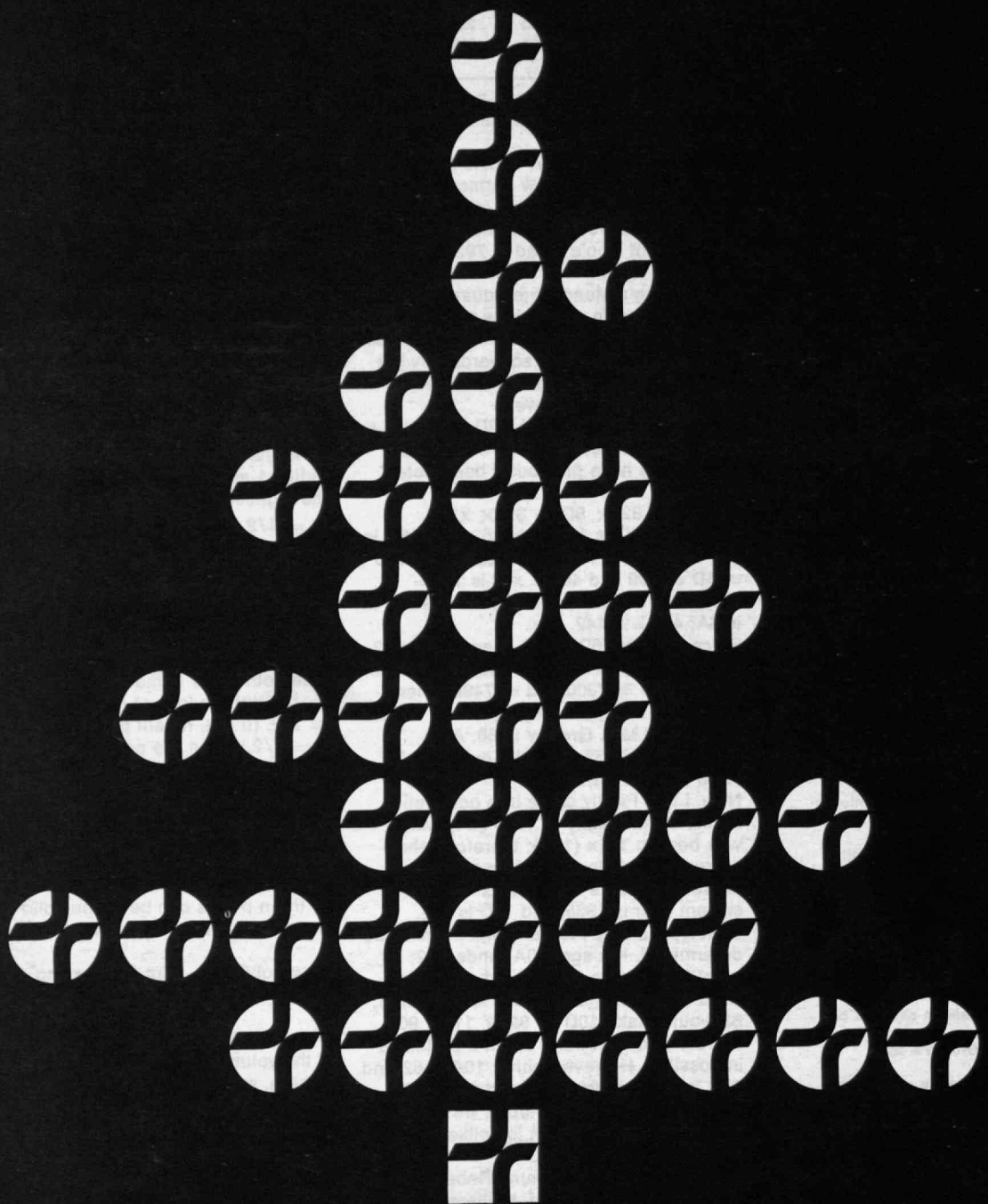
Mr. Wagstaff submitted the following solution with the drawing below:
With no loss of generality, we can assume that there are two points whose distance apart is the maximum of 1. (If not, change scale.) Rotate and translate the point [set such that these two points] are (0, 0) and (1, 0). Then all the points lie in the intersection of the disks of radius 1 about (0, 0) and (1, 0). Let C be the highest circle with center on the line $x = 1/2$ and radius $\sqrt{3}/3$ such that none of the n points is below the lower semicircle of C. Such C exists, is unique, and has some point p of the n points on its lower semicircle. No points are omitted below C, so either C does the job or there are points left out above C but inside both disks (solid region). Let p = (a, b). With no loss of generality, $0 \leq a \leq 1/2$. (If not, reflect point set in the line $x = 1/2$.) Then the center of C is $(1/2, b + \sqrt{1/3 - (a - 1/2)^2})$. Clearly the nearest point of the shaded region to p is the intersection of C with the circle with center (1, 0), and a short calculation shows that the distance of this point from p is greater than or equal to 1. So none of the n points can be in the solid region because is would be too far from p.

Also solved by John E. Prussing. Frank Rubin, and Mark Yu.

34 a and A are the surface areas, v and V the volumes of a smaller and a larger sphere, respectively. If A = (a + 10) square inches and V = (v + 10) cubic inches, what are the corresponding radii? Solve to two decimals!

The following solution is from William R. Osgood: With R and r the radii of the larger and smaller spheres, respectively, write the relations between the surface areas and volumes as
$4\pi R^2 = 4\pi r^2 + 10$
$4/3\pi R^3 = 4/3\pi r^3 + 10.$
Substitution of r from the first into the second gives, after some simple algebraic manipulation:
$R^4 + 15/2\pi + 25/12\pi^2$
$= 2R^3 + (5/2\pi)R^2$, or
$R^4 + 2.598 = 2R^3 + .7958R^2.$
Solution of this equation by trial yields R = 1.22 in. The first equation then gives r = .83 in.

Also solved by Frederick Cleveland, Richard Hanau, Thomas Kennedy, Cornel Lomogy, John E. Prussing, Edward Reed, R. Robinson Rowe, Frank Rubin, Donald E. Savage, Smith D. Turner, and Samuel S. Wagstaff, Jr.



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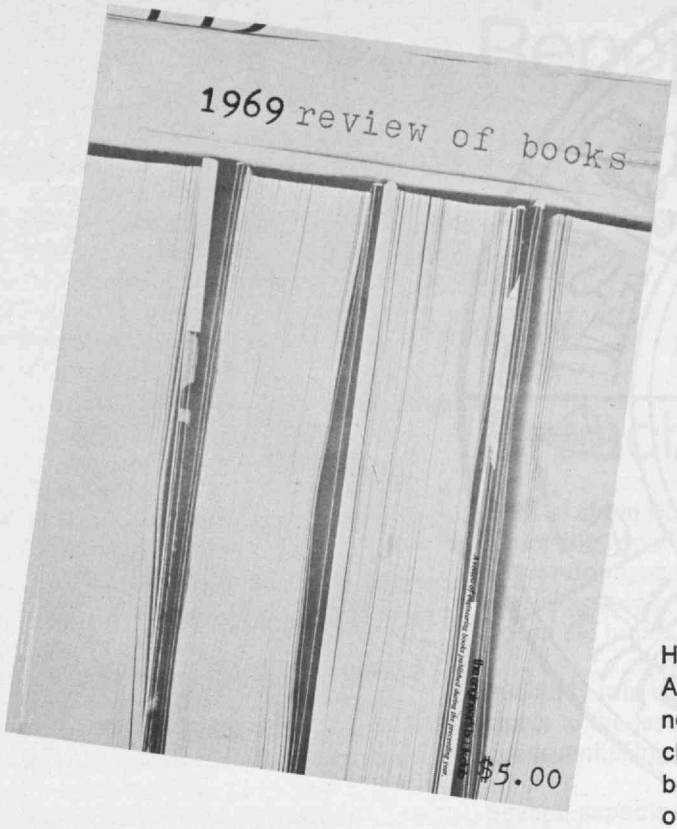

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Special Report

Breaching "a Seamless Web"

Cries of alarm from universities and foundations are greeting the Tax Reform Act of 1969 now under study in the Congress—not because anyone objects to tax reform, as the alarmists are quick to point out, but simply because its provisions seem to threaten the entire fabric of philanthropy into which is woven the future of U.S. private higher education.

Suddenly it is clear that—perhaps to a degree greater than most of the principals to the issue had realized—national tax policy has become a complex but essential ingredient in education and philanthropy.

Several aspects of the Tax Reform Act (H.R. 13270) passed by the House of Representatives in August—it is described by *Fortune* magazine as providing "the most far-reaching changes in the tax code ever written"—have been brought into question by officials of universities and foundations:

1. The new bill would make a donor of property whose value had appreciated during his ownership of it in some way liable for taxes on a variable part of the increase in value. There is now no tax on such appreciated value. The proposed regulations are described as making it virtually impossible for a donor to plan his giving; his annual tax obligation would be incalculable until the end of each tax year.
2. A donor who gives major funds to a university under the plan of receiving income from this capital during the balance of his life—or who gives a portion of his estate upon his death—is now subject to tax obligations that markedly reduce the value of his gift.
3. A foundation—along with the recipient—would become subject to severe penalties if money it has given is used to influence legislation.
4. Private foundation investment income would be subject to a tax of 7½ per cent and to other "abusive" conditions.

Threat to the Search for Truth

There is evidence that the House Ways and Means Committee, where the new legislation was drafted—working under the pressure of public demand for tax reform accompanying extension of the income tax surtax—did not intend to visit grave hardship on all foundations or educational institutions. Indeed, while current law limits gift deductions for most taxpayers to 30 per cent of gross income, the act now before the Senate would increase this to 50 per cent. Many of the new provisions affecting foundations were seen as devices to end abuses which most major foundations agree should be ended.

But the results would be far-reaching. Howard W. Johnson, President of M.I.T., has said that "the bill as written will inevitably have an adverse impact on the future financial support of educational institutions." Kingman Brewster, President of Yale University, has written that "the dampening of private charitable initiative could bring a serious threat to the autonomy, vitality, and

Towards "Thoughtful Experiment" and "Constructive Innovation"

The following are excerpts from the statement of Julius A. Stratton, President Emeritus of M.I.T. who is Chairman of the Ford Foundation, for the Finance Committee of the U.S. Senate concerning the Tax Reform Act of 1969:

"I come before you with a deep concern for the future of philanthropy in our country and for the viability of many institutions whose very existence depends upon funds from private sources—institutions whose ideas and ideals are basic to our American concept of a democratic society. My own perspective of the needs and benefits of philanthropy has developed over the years that I have spent in the field of education, as a former Provost and President of the Massachusetts Institute of Technology and as a trustee of various colleges and institutions cultivating the arts and the sciences. Then as a trustee of the Ford Foundation during the past 14 years and as Chairman of its Board since 1966, I have learned something at firsthand of the hazards and complexities as well as the satisfactions of giving.

"Out of this total experience I have come to the profound conviction that charitable foundations have an obligation to society that goes beyond a merely passive response to pleas for help. They have an obligation to search out new ways and means of meeting pressing needs in our society and supporting responsible institutions and organizations which have the competence to help in resolving them. Foundations serve the highest national purpose in advancing our tradition of many roads to progress. To this end they must enjoy the freedom to encourage thoughtful experiment and to stimulate constructive innovation.

"In saying all this, I do not mean to equate freedom with license. Every witness here today, I am sure, acknowledges the need for clear guidelines and standards of action. We recognize as well that these must be reviewed and revised as the concept of foundations evolves. My particular concern, however, is that some of the rules and guidelines set forth in the bill before you are difficult to interpret, with implications which I can only believe were neither foreseen nor intended, and which if enacted in their present form would have a devastating effect upon the contributions of American philanthropy to the public good.

* * *

"From the time of our founding as a nation, the American people have sustained their faith in the value of having other forces at work besides the government. . . . I firmly believe that the times ahead will test, more severely than any in our history, the strength of our democratic institutions. This is hardly the moment to restrict the capacity of the private sector of our society to meet greater and greater challenges."

quality of an inherently risky, controversial task of searching for an unknown truth." Indeed, the uncertainty created by the proposals is already taking a heavy toll in major giving, according to M.I.T. officials.

James R. Killian, Jr., Chairman of the M.I.T. Corporation, told the Senate Finance Committee that if the House bill becomes law "it will probably constitute the death knell of the foundations as we know them." And Julius A. Stratton, Chairman of the Ford Foundation and President Emeritus of M.I.T., has said that the tax bill's provisions "would have a devastating effect upon the contributions of American philanthropy to the public good."

Because the provisions are so complex, a simple explanation of their consequences is difficult and hazardous.

By taxing some portion of the donor's gains on appreciated property given to a university, the bill is closing what some regard as a "capital gains loophole." But M.I.T. has received nearly $31 million—or 27 per cent of all donations—in the last four years in the form of securities, according to Frederic W. Watriss, Assistant Treasurer, and some 38 per cent of all gifts from individuals have been in the form of securities. "It is reasonable to assume that all these securities had significantly appreciated in value while held by the donors," Mr. Watriss says. "The new law presents a clear danger to this important source of giving."

The new tax bill provides no deductions for gifts of capital to be held by universities as "life income" or annuity funds except under special conditions—and indeed imposes retroactive taxes on capital gains on existing trusts. At M.I.T. such gifts have represented more than 6 per cent of total contributions during the past four years, according to Mr. Watriss, and two-thirds of the total contributions received in this period from individuals came through testamentary and intervivos trusts. During the last four years, foundations contributed 36 per cent of M.I.T.'s total gift support and individual donors 51 per cent. Of the total of individual giving, 67 per cent came to the Institute through testamentary trusts and bequests.

Taxing the Tax-Exempt

If enacted, the proposed 7½ per cent tax on foundation income would be "the first breach of the tax-exemption principle," Dr. Killian told the Senate Finance Committee. Experience shows, he said, "that once a tax exemption is breached, almost inevitably progressively higher taxes are later imposed. I am also troubled," he added, "about the precedent created by taxation of foundations as implying the possibility of taxation of our tax-exempt educational institutions."

The new bill's limitations on foundation activities which can be seen as influencing legislation seem so broad and undefined as to eliminate much present foundation activity, according to Dr. Killian. Indeed, he told the Senate committee, "These provisions could reduce the officers and trustees of our responsible foundations to a legion of intimidated men, their initiative, imagination and boldness dampened by excessive restraints and surveillance and by confiscatory penalties for the innocent misreading of ambiguous provisions."

In summarizing his overall views to the Senate committee, Dr. Killian expressed his concern for the impact of the bill "on the future of all philanthropy. The preservation of the great American tradition of benevolence, of voluntary association, of diversity of support for our charities, must be looked at in the round because the spirit of generosity is a seamless web, and damage to a part damages the whole," he said.

Defense Research and the Public Interest

The emphasis—and perhaps even the posture—of the Massachusetts Institute of Technology as a source of research for U.S. national defense is changing.

Following the report of a special commission of M.I.T. faculty, students, and Corporation last spring (*see* Technology Review *for June, 1969, pages 72A-72C*), the Executive Committee of the M.I.T. Corporation has adopted, and the Corporation has approved, an intensive effort toward a more balanced research program in M.I.T.'s "special laboratories." At the same time, says a Corporation statement, "it would be inappropriate for the Institute to incur new obligations in the design and development of systems that are intended for operational deployment as military weapons."

Both the Corporation and Howard W. Johnson, President of M.I.T., hasten to add that this does not in any sense mark the end of the Institute's contributions to defense research. Both agree that M.I.T. will fulfill all existing commitments, including program commitments to Poseidon in the Instrumentation Laboratory which extend at least until 1974.

The Corporation statement continues by saying that the Institute, "with its unique qualities, . . . should continue to be involved in advancing the state of technology in areas which have defense application." And President Johnson in his annual report to the Corporation on October 3 wrote that "the continued need for substantial effort in defense technology . . . is part of our responsibility to the nation. This responsibility should continue," he said.

The new moves are rather an effort to swing from applied military research on weapons systems toward more basic studies whose applications are not limited to military objectives.

Two "Special Laboratories"

At M.I.T., most research for military purposes is conducted in the two "special laboratories" operated mainly with funds granted by the U.S. Department of Defense. Lincoln Laboratory—funded almost entirely by defense agencies—has worked on radar and other air defense systems, re-entry technology, and computer science, and a substantial component of its program consists of basic research in support of these areas.

The Instrumentation Laboratory grew out of research on sophisticated fire control systems developed for U.S. air and naval power during World War II. Since then the Laboratory has become the nation's chief resource for the theory and practice of inertial guidance, navigation and control—including the design of the navigational systems for the Apollo moon-landing program under N.A.S.A. sponsorship. In recent years the Instrumentation Laboratory has turned increasingly to collaborative undertakings with other U.S. groups in fields ranging from oceanography and biomedical engineering to air traffic control and ground transportation. And clearly this emphasis will continue.

Many members of the Instrumentation Laboratory are quick to point out that the Laboratory's expertise in guidance and control is essentially unique in the U.S. It developed, they say, in partnership with M.I.T.'s academic work in the Department of Aeronautics and Astronautics, through which have graduated most of the country's current experts in the field. The Laboratory represents a national resource which cannot soon be recreated in a field essential to U.S. security, they say; and they ask: Is there no place for such powerful technology and its application at M.I.T.?

New Challenges of the 1970's

Upon his retirement at the end of 1969 as its Director, the Laboratory will be

C. S. Draper

C. L. Miller

Instrumentation Laboratory: From One "Systems Man" to Another

Charles L. Miller, Head of the M.I.T. Department of Civil Engineering and of the Institute's Urban Systems Laboratory, has been named to succeed Charles S. Draper, Institute Professor Emeritus and former Head of the Department of Aeronautics and Astronautics, as Director of M.I.T.'s Instrumentation Laboratory upon Professor Draper's retirement on January 1, 1970.

The name of the Laboratory will be changed to the Charles Stark Draper Laboratory to recognize Professor Draper's "brilliant and enduring contributions to the country through pioneering technology," in the words of M.I.T.'s President Howard W. Johnson.

Professor Miller, who graduated from M.I.T. in 1951, has won acclaim for his imaginative applications of systems engineering concepts—in many ways similar to those by which the Instrumentation Laboratory has approached control and guidance problems—to civil engineering. He is the author of COGO—a command-structured, problem-oriented language for geometrics problem-solving on a computer—which in turn has been incorporated into an Integrated Civil Engineering System (ICES) which brings the power of the computer to the service of designers in numerous engineering fields. More than 500 organizations are now using the system for work in transportation, urban development, housing and construction engineering.

The Urban Systems Laboratory, which Professor Miller has headed since its founding in 1968, is a federation of research groups in various departments with interests in urban problem-solving. "It represents a major commitment of M.I.T. resources to the growing national problem of city building, management and improvement," according to President Johnson.

Professor Draper founded the Instrumentation Laboratory in 1941, and he has been its "guiding genius" ever since. He came to M.I.T. as a student in 1922, earned three M.I.T. degrees (S.B. 1926, S.M. 1928, and Sc.D. 1938), joined the teaching staff in 1929, and was Head of the Department of Aeronautics and Astronautics from 1951 to 1966. He holds the National Medal of Science (1964) for "innumerable imaginative engineering achievements."

named in honor of its founder, Charles S. Draper, Professor of Aeronautics and Astronautics Emeritus who—in President Johnson's words—is "recognized throughout the world as the 'father' of inertial guidance." It is significant that the Laboratory's new Director *(see previous page)* will be Charles L. Miller, former head of the M.I.T. Department of Civil Engineering and Director of the Institute's Urban Systems Laboratory.

In announcing this change in the management of the Instrumentation Laboratory, President Johnson wrote to the M.I.T. faculty that "the challenges of the 1970's will call for new steps to be taken to organize our resources and to prepare for new roles in public service that relate to the needs of the nation." Defense research will clearly be among these. But the priorities may be different, and the Institute's willingness to participate in applied weapons research is clearly ending.

"... According to an Unwritten Body of Common Law"

The following are excerpts from a statement of the M.I.T. Faculty Committee on Discipline concerning its role and position on student conduct and privileges issued at the Institute on October 9, 1969:

"The university has the function of nurturing ideas and imparting knowledge. This purpose can be attained if no arbitrary restrictions are imposed from without or within on the nature of the ideas, on the act of communication itself, and on the freedom of persons to assemble peacefully and to enjoy privacy. Interference with this basic process whether it comes from outside or inside the community cannot be permitted.

"The minimal restraints required to protect the academic process can never be defined rigorously. Rather, the Institute functions according to an unwritten body of common law. Each violation must be considered in its own context and in its relation to the body of common law.

"We observe that students, faculty, administrators, alumni and guests on campus have very deep feelings about the war in Vietnam and other social issues which occasionally lead them to act with passion and rage—feelings entirely consistent with their convictions. Nevertheless, we take the view that disruptions of free communication and of the freedom of persons to assemble peacefully and to enjoy privacy, while appearing expedient to some, are harmful to the community at large."

On Preserving Freedom(s)

Every American campus felt a dilemma watching its students returning this fall: a new year of the work to which all are committed begins; but must the seeds of destruction—which exist on every campus facing pressures for change—in fact germinate?

They must not at M.I.T., said Howard W. Johnson, President of the Institute, in an open letter to the community on the first day of classes.

The M.I.T. campus, President Johnson wrote, must "remain an open place where free minds can meet, a free place where open minds can grow. . . . Coercive acts, from any quarter, which clearly threaten the opportunities of others to speak and act as they, in conscience, see fit, invariably hurt every man in this community. To allow such acts, surely in my view, asks for their escalation from all extremes.

"The Institute is committed to self-examination and to dynamic growth and change. . . . Differences of opinion clearly exist, and they will continue. The problem for all of us is that coercion blocks the channels, breaks the communications, and destroys the opportunities for effective change.

"I want to state it so it is clear to all," wrote President Johnson, "that our procedure, in the face of coercion or threat to the freedom of this campus, will be to call for immediate review and action by the appropriate judicial group."

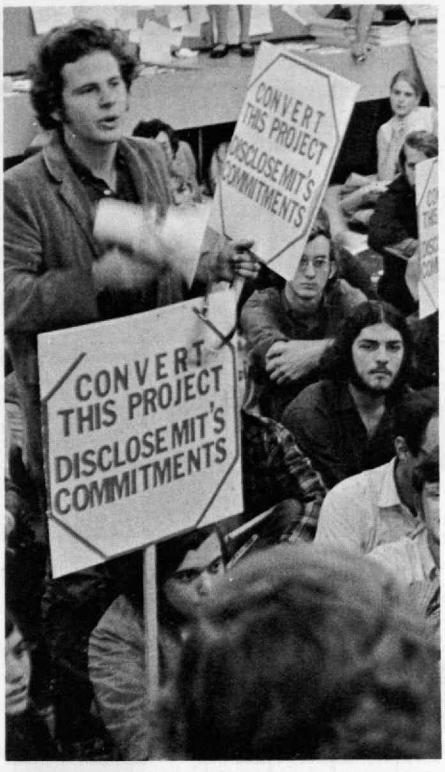
Those in the M.I.T. community who sought a stronger or more explicit statement of limits and consequences were disappointed, left to ponder the value of their own freedom and responsibility in meeting events, conducting dialogues, and making decisions.

The Strained Concepts of Academia

On every U.S. campus this fall most of the headlines belong to the radicals. At M.I.T., as elsewhere, they are the minority—how small a minority may be immaterial. For they are the chief stimulants (constructive or destructive) of change—change in process, goals, philosophy. And so, despite their small numbers (and at least in part because of their tactics), today's radicals must be heard and understood.

M.I.T.'s radicals group themselves into three organizations, the Science Action Coordinating Committee (S.A.C.C.), the Students for a Democratic Society M.I.T Chapter (M.I.T.-S.D.S.), and the Rosa Luxemberg S.D.S. (R.L.-S.D.S.) named for a German Communist of the 1930's.

At least 150 students, members of S.A.C.C. and R.L.-S.D.S., pressed for admission to the annual meeting of the M.I.T. Corporation on October 3, and after considerable scuffling and confusion some 20 were admitted to present views on Vietnam, the role of M.I.T. in defense research, qualifications for Corporation membership, and "the generation gap between you and us," as George N. Katsiaficas, '70, put it. Meanwhile, those outside the Schell Room (above), where the meeting took place, listened to the proceedings through loudspeakers. (Photo: Richard M. King, '72, from The Tech)



A Guide to M.I.T. Radicals

Take each group in turn, and oversimplify its platform and sources:

S.A.C.C. was born in the planning of the March, 1969, "research strike" at many U.S. universities to protest defense-related research. S.A.C.C. continues this year to involve mainly graduate students on the issues of defense research and the Vietnam war. In its statement to the annual meeting of the M.I.T. Corporation early in October S.A.C.C. demanded "that you recognize M.I.T.'s genuine commitments . . . by disclosing the extent of its (contracts) . . . and redirecting its resources to socially essential projects." The Poseidon-M.I.R.V. research in the Instrumentation Laboratory, "being the most blatant misuse of M.I.T.'s resources," said S.A.C.C. literature, "is the place to begin."

The M.I.T.-S.D.S. is far more radical in posture if lesser in membership, and it is closely aligned with the Peace and Freedom Party and the national S.D.S. Its basic premise is the "worker-student alliance" to "end oppression of the working class." In its most recent pamphleteering, M.I.T.-S.D.S. says that "an alliance between students and workers is the primary way that the student movement can fight all the ways that people are hurt by the bosses in this country—the war, racism, and the exploitation of workers." It pledges to focus action on university expansion in Cambridge.

War-related research is almost the singular focus of R.L.-S.D.S. at M.I.T. Its leadership is hard, bright, outspoken—and apparently uncompromising. Michael A. Albert, M.I.T. Undergraduate Association President, had a major role in stimulating many of the debates on policy at M.I.T. in 1968-69—curriculum reform, defense research, R.O.T.C., and others. This year, as leader of the R.L.-S.D.S., his goal is more single-minded. On October 5 he wrote in the *Boston Globe,* "For us at M.I.T. the task seems clear. We must raise the price of the war until its masters end it. . . . We shall end war-related research at M.I.T. No more helicopter work, no more counter-guerilla projects, no more M.I.R.V., no more counter-insurgency work in the Center for International Studies; indeed, the Center may well have to be closed in its entirety. M.I.T. has already . . . developed a million fabrications and justifications for American imperialism—it is going to come to an end.

"In early November," wrote Mr. Albert, "there will likely be city-wide demonstrations at M.I.T. against the projects mentioned here and others. M.I.T. is the Second Pentagon. . . . At M.I.T. in November we will protest the war, protest imperialism, support the N.L.F., and put an end to the machinations of the Second Pentagon."

The Inner Strength of Community

In his 1969 annual report to the M.I.T. Corporation, President Howard W. Johnson referred to "the unwritten compact that holds any university community together: that here, above all other places in our society," he wrote, "is a refuge from the censor, where any individual can pursue truth as he sees it, without interference by any man or any group."

Yet President Johnson also emphasized the need for M.I.T. to "remain open to learning at a time when polarized views and political tendencies strain the delicate ties of trust and tolerance that form the basis for free exchange."

And Dr. Benson R. Snyder, Dean for Institute Relations, warned a committee of the M.I.T. Corporation in October that "when an institution begins to move on the basis of distortions of rhetoric, it ceases to be an educational institution." He joined President Johnson in noting what Mr. Johnson told the Corporation was the M.I.T. community's "commendable ability to accept change supported by reason, despite the noisy distractions that often surround its advocacy."

Though he could give no direct assurances for the future, Mr. Johnson told the Corporation that "we have found how much inner strength the idea and community of M.I.T. possess."

Tech-Crostic
David L. Holt

Nutritional Wisdom

				W 1	G 2	I 3	Z_1 4	X 5	N 6	A 7	P 8		Y 9	B 10	J 11	O 12		K 13	U 14	E 15	
L 16	X 17	Z_2 18	V 19		E 20	N 21	J 22		N 23	I 24	E 25	Z 26	Y 27	K 28	M 29	R 30	D 31	Z_1 32		D 33
I 34	A 35	Y 36	Z_1 37	N 38	Q 39	X 40		S 41	G 42		T 43	Y 44	Z_2 45	Z_1 46	N 47		H 48	Z 49	B 50	K 51
V 52	Y 53	N 54	E 55	C 56	R 57		K 58	Y 59	M 60		H 61	R 62	P 63	L 64	Z_1 65	F 66	Y 67		N 68	J 69
	T 70	S 71	G 72	A 73	M 74	P 75		Q 76	T 77	X 78	P 79	D 80	F 81	Z_1 82	Y 83		Y 84	N 85	O 86	U 87
	B 88	Z 89	Q 90	E 91		K 92	V 93	E 94		N 95	D 96	P 97	U 98		I 99	W 100	P 101	Z_1 102	O 103	
C 104	M 105	T 106	N 107	V 108		S 109	P 110	N 111		V 112	A 113		U 114	Y 115	F 116	O 117	E 118		G 119	Z 120
D 121	Y 122	M 123	B 124	T 125		U 126	E 127	N 128		X 129	I 130		T 131	Y 132	C 133	H 134	Q 135	Z 136	W 137	X 138
U 139	E 140	M 141	B 142		A 143	V 144	L 145	D 146	Z_2 147	E 148	K 149	S 150		J 151	A 152	S 153	Y 154	M 155		E 156
I 157	N 158	B 159	S 160		P 161	T 162	V 163	H 164	N 165		M 166	X 167	C 168		Q 169	F 170		U 171	D 172	H 173
T 174	X 175		J 176	W 177		R 178	L 179	N 180	Z_2 181		E 182	Z_1 183	Y 184	P 185	M 186	E 187	J 188	N 189		

Use the definitions at the right to help define the words to which they refer; then enter the appropriate letters in the diagram to complete a quotation from a work on biochemistry. The first letters of the defined words give the author and title from which the quotation is taken. Black squares in the diagram indicate the ends of words; when there is no black square at the right end of the diagram, the word continues on the next line.

The correct solution to this Tech-Crostic appears on page 85 of this issue of *Technology Review*.

David L. Holt is Assistant Professor of Metallurgy at M.I.T. He will welcome readers' comments; address him in care of *Technology Review*, Room E19-430, M.I.T., Cambridge, Mass., 02139.

A. Semitic deity.

73	113	143	35	7	152

B. Neigh.

88	10	124	159	50	142

C. Star which becomes relatively obscure after a great burst of light and energy output.

168	133	56	104

D. An external parasite or commensal.

146	33	80	31	121	172	96

E. A simple machine (2 words).

55	127	20	148	187	91	15	94	182

140	156	25	118	

F. No points scored.

66	116	81	170

G. Slang for those in society who are considered significant or consequential.

2	72	119	42

H. A substance separated from material in which it already existed.

61	164	173	48	134

I. To branch out.

34	99	157	3	130	24

J. Strongly astringent substance obtained from gallnuts, sumac etc.

151	11	188	69	176	22

K. Execute.

28	58	92	149	51	13

L. Explosive projectile.

145	179	64	16

M. To behave, for example, as iron when cooled to 690°C.

60	123	105	74	141	155	29	166	186

N. Condition due to disorder of the suprarenal glands (2 words).

21	107	128	158	165	95	6	23	111

38	189	85	68	54	47	

O. Tax.

12	103	86	117

P. The creative principle, impulse of life (2 words).

8	97	161	110	79	101	185	63	75

Q. Dice.

169	135	39	90	76

R. Wild goat.

30	178	57	62

S. Indian tribe, formerly inhabiting central New York.

160	71	153	41	150	109

T. Five-line stanza.

162	106	125	43	77	70	131	174

U. In the middle.

14	126	87	171	114	139	98

V. Paradisiacal.

93	52	19	108	163	144	112

W. Bearing.

100	137	1	177

X. Vesuvianite.

129	175	17	138	78	167	40	5

Y. S. 22° 30′ W. (Comp.).

132	184	44	9	27	154	59	53	36

115	84	67	83	122	

Z. Cluster of buildings, a hamlet.

26	89	49	120	136

Z_1. Group of digits which, when repeated indefinitely in the same order, constitutes a repeating or circulating decimal.

183	37	65	32	46	82	102	4

Z_2. Type of zwitterion.

181	147	45	18

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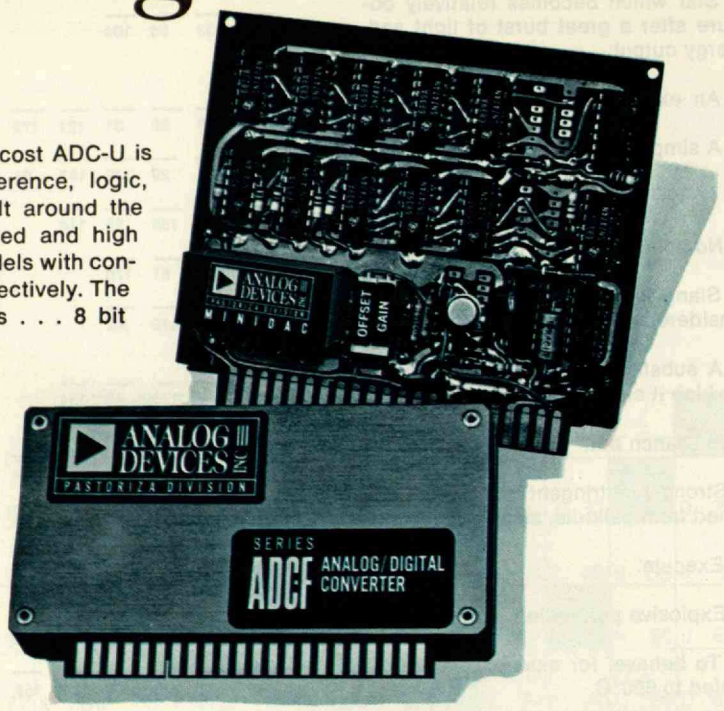

& Back Again

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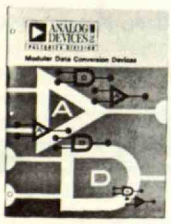

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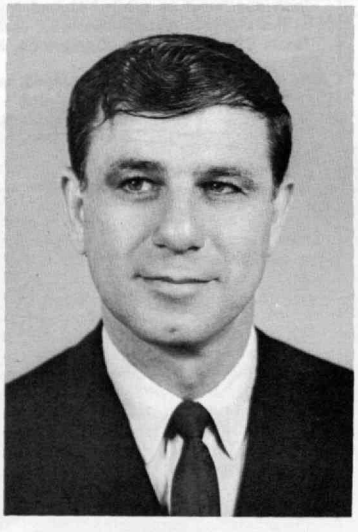

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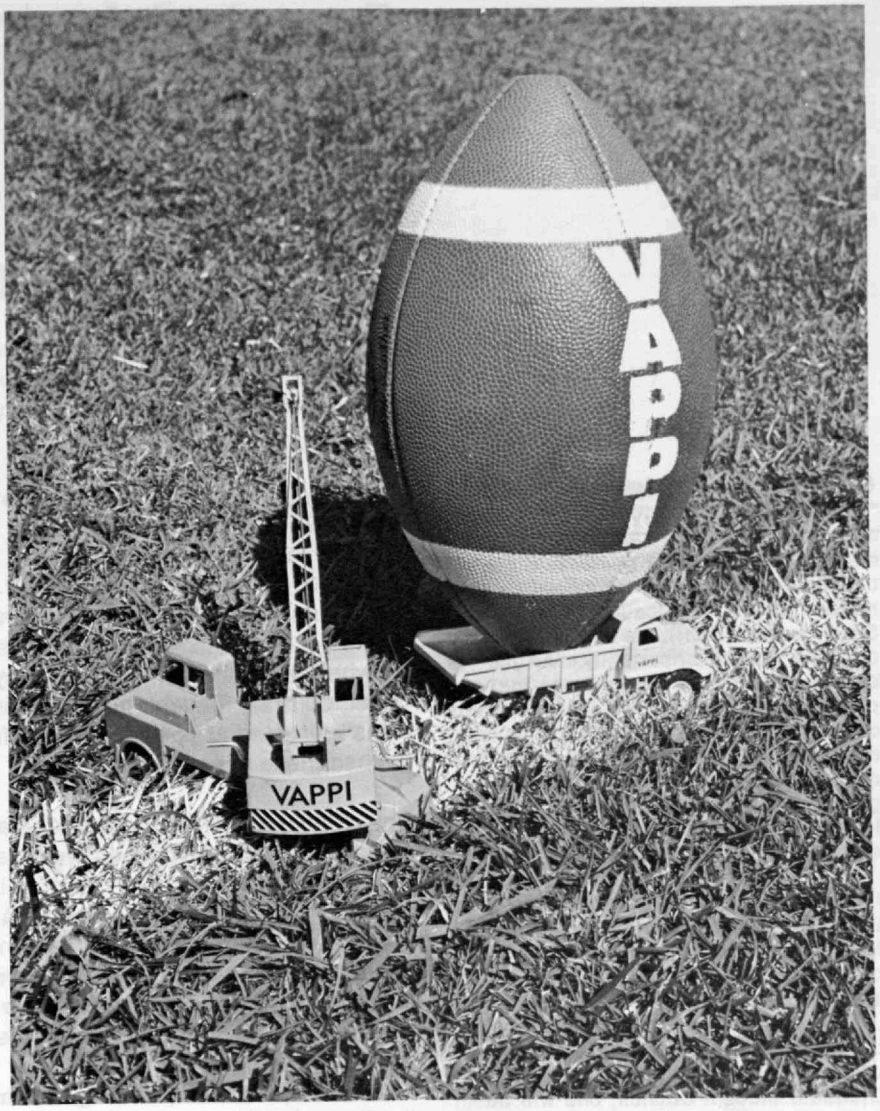

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Cambridge Journal

Community Participation Toward "the Spirit Uniquely M.I.T."

In addition to its other goals, said the committee planning the proposed Commission on M.I.T. Education in the Seventies (*see right*), the Commission has one very special opportunity. "An increasing number of students see the power of M.I.T. but do not sense the spirit of the Institute which is still so vivid for many of the faculty." Thus the new commission "must try to bring people together and formulate a conception of the Institute which captures the ethos—the spirit which is uniquely M.I.T."

If the planning committee's recommendations are followed, the Commission on M.I.T. Education in the Seventies will be composed of 10 to 12 members designated by the President. Two will be undergraduate students recommended by student government; two will be graduate students recommended by the Graduate Student Council; one will be "a person whose primary responsibility is outside the M.I.T. community;" one will be a non-tenured member of the teaching staff or faculty; one will be in an administrative position at the Institute; and three to five will be members of the faculty.

The Commission will have special staff assistance, including student employees. In addition, there will be task forces for special purposes, seminars on special problems, publications, and a series of public meetings. In commenting on the committee proposals, President Johnson said he "especially welcomed the vision of a variety of opportunities for everyone at M.I.T. to . . . contribute substantively and substantially" to the Commission's work.

President Johnson promised to appoint the Commission so that it can begin work by Mid-October. Its final report would be due in September, 1971, with interim reports and recommendations to be published as they are prepared during the coming two academic years.

Questions for the Seventies

Will American universities—and M.I.T. in particular—play a significant role in pointing the way for society, or are they merely to follow?

To what extent should M.I.T.—or any other university—maintain its traditional focus on fundamental knowledge? Or should it attempt "social missions" directed at specific needs of society, however seen, and who shall choose these missions and needs?

How should a professional school teach its students concern for the value systems which apply to their work?

After six weeks of intensive effort, a blue ribbon planning committee of M.I.T. faculty this summer reported its conclusion that these are among the central questions facing American higher education in general and M.I.T. in particular. They should be at the top of the agenda of the Institute's proposed Commission on M.I.T. Education in the Seventies.

Five issues, said the planning committee, should be raised and resolved by the Commission, the creation of which President Howard W. Johnson proposed to Corporation, faculty, and students during the final weeks of the 1969 spring term:

◇ M.I.T. in immediate contact with society. ". . . Are there long-term conflicts between efforts to meet immediate social needs and the fulfillment of long-term commitments in education and basic research?"

◇ Educational programs and methods. ". . . An increasing number (of students) have come to feel that our educational program does not allow them to develop in such a way as to have a full and meaningful life. . . . Does the prevailing posture of scholarly neutrality inadvertently serve the status quo?"

◇ The individual. "Look closely at the situation of the individual in the M.I.T. community, especially with respect to admissions, advising, ways of learning, and the role of the faculty."

◇ Research. "Who should decide which projects are suitable for the Institute to undertake? . . . Will it be either necessary or possible to develop criteria of appropriateness for faculty research in sensitive areas, e.g., computer invasions of privacy or genetic manipulation? What would be the effect on academic freedom of such criteria?"

◇ Administration and governance. "There are many factors at M.I.T. that make rapid change difficult. . . . In a period of change and adjustment such as we seem to be entering, special attention must be paid to the development of methods of change."

In proposing a broad study of the nature and purposes of M.I.T. education, President Johnson said during the summer that "too much is still decided on the momentum of tradition. An institution can survive for a long time on that basis," he said, "as long as it is not challenged. But when it is challenged . . . it must state its purpose, in contemporary terms that give promise for the future, or it may lose what it has."

Withdrawal from Sao Paulo

Last spring, M.I.T. and the Smithsonian Institution agreed to co-sponsor a U.S. entry for the most important international art exhibition in the world, the Bienal de Sao Paulo, Brazil, to be prepared by the M.I.T. Center for Advanced Visual Studies.

The exhibit was to document the objectives of the Center by interrelating different artists' works. The exhibit would have demonstrated the social and communicative functions of artistic forms and their interdependence among people as well as technology.

But in July, Gyorgy Kepes, Director of the Center, announced that the entry would not be sent because of the problems posed by the withdrawal of nearly half of the participating artists. The artists withdrew, he said, to protest oppression of Brazilian artists and other intellectuals by the ruling military regime there.

The story behind the withdrawal of the entry, however, points up other issues. How can the artist be most effective? By continuing to work and exhibit under all civic conditions? Or by using more directly political means, such as the boycott chosen by nine of the 23 U.S. artists?

The artists agreed to undertake the exhibit in May despite several known obstacles. One was the risk of exhibiting in the Brazilian capital, since there were rumors of confiscation of art works by the authorities there. Another was the fact that the funding was not yet final. And a third was the harrowing schedule: they had two months in which to prepare a full-scale exhibit.

Meanwhile, Professor Kepes tried to learn whether the political situation in Sao Paulo might prejudice the chances of a successful—and peaceful—exhibition. Brazil's former President Kubitscheck encouraged him to exhibit. Another famous Brazilian, Roberto Burle Marx, a principal designer of Brazilia, wrote: "The artist shows his work and his world . . . and that message gives us hope and belief in humanity. Artists exhibit for the people, not the government."

However, a movement to boycott the X Bienal gathered ground in Europe, causing several national withdrawals and many individual ones. It spread to the U.S. in June. In early July several of the previously enthusiastic artists wrote to Professor Kepes that they felt they could not participate. The last withdrawals occurred literally days before the exhibit was to be shipped.

Professor Kepes himself said he also objected to the Brazilian dictatorship, but he believed in the importance of direct communication by exhibiting. In fact, the text he wrote introducing the exhibit explained why interdisciplinary, social art must have freedom: "Artists cannot bring their insights to bear on the manifold ecological tragedies without a climate open to explore possible options with optimum intensity and freedom."

Thus, the decision to withdraw the exhibit was made, finally, "for artistic reasons." The philosophy of the exhibit was that it was "an orchestrated whole"—which of course was impossible after the nine withdrew. The Smithsonian will show the entire exhibit in Washington early next year, and a full catalog is now being published.

The Need for Social Art

The following is exerpted from the text of the introduction to the U.S. entry planned for Bienal, Brazil's famous art biennial, by Gyorgy Kepes, Director of the M.I.T. Center for Advanced Visual Studies. Although the entry will never be shown in Brazil (see story, left) the philosophy of the artist as a social animal—an interested part of a multi-disciplinary society—remains.

"Creative life and human knowledge advance by the interaction of the whole community. All society has become an intricately interacting system that can survive only through the interconnected workings of its members.

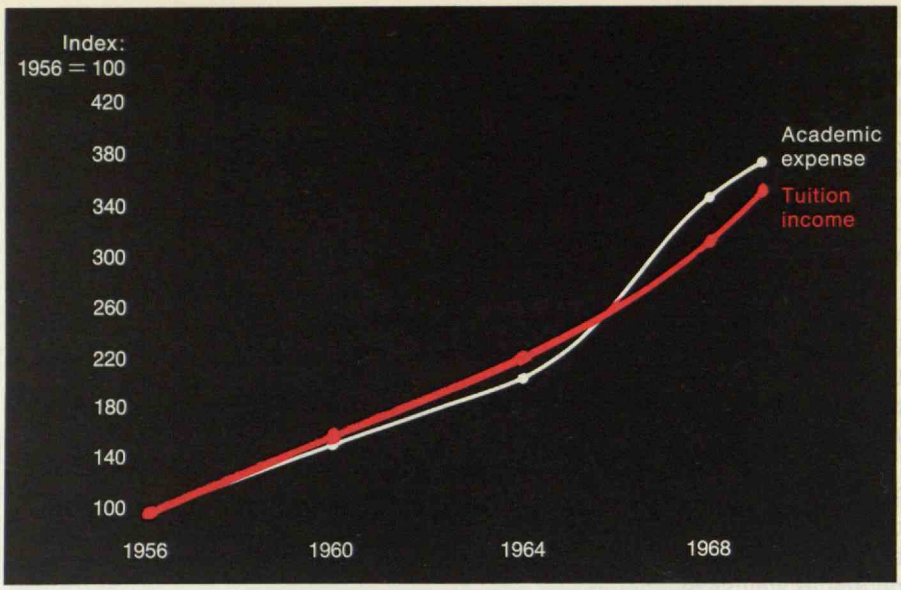
Artists "are beginning to accept interdependence personally, professionally, and ecologically—to recognize the balance that modern man so urgently needs to establish with the total of his environment.

"In becoming a collaborative enterprise where artists, scientists, urban planners, and engineers are interdependent, art has clearly taken on a new orientation in which its prime goal is the revitalization of the entire human environment. By addressing himself to such a task, the artist is . . . clearly forging a new relationship of social responsibility with respect to his fellow men.

"But artists cannot bring their insights to bear on the manifold failures of our contemporary life without a climate open to intellectual liberty. . . . A claustrophobic, repressive atmosphere cuts them off from others, from the very sources of their insights, stifling imaginations that are seeking patterns of integration and interconnectedness. Their dreams will prove abortive if social conditions prevent them from becoming concrete, if they go unsupported by civic understanding.

". . . The artist's effective contemporary role depends on a general national and international condition in which individuals, groups of the society, or nations can participate in shaping their own lives as equals among equals."

Despite regular increases in tuition at M.I.T. since 1956, the Institute's tuition income has barely met its share of rising academic expenses, which do not include administration, building maintenance, and research. The total of academic expenses is about 50 per cent greater than tuition income, the difference being made up from endowment income, gifts, and special grants.



Inflation and the Student: Protecting the Most Vulnerable

The high cost of going to college (*see right*) is news neither to students nor their parents—nor to the nation's hard-pressed financial aid officers, for whom every tuition increment is multiplied several hundred fold.

The $350 increase announced by M.I.T. for June, 1970, puts two questions before M.I.T.'s Student Aid Center and the faculty Committee On Undergraduate Admissions and Student Aid: From whence can come the new resources needed to maintain M.I.T.'s pledge of "assistance equal to his financial need" for every admitted student? And how can the various resources be most equitably divided among students needing financial help?

The plain fact is, says Jack H. Failey, Director of M.I.T.'s Student Aid Center, that existing resources will not be enough. Already M.I.T.'s Technology Loan Fund is being supplemented by the National Defense Student Loan Program, a federally-guaranteed low-interest fund. But by September, 1970, some students probably will be asked to take some aid in terms of wages for on-campus or study-related jobs; or to turn to the federal Guaranteed Loan Program.

The more difficult question is how to determine the exact mix of scholarship, loan, and work which any student receives to meet his financial need.

Present policy at M.I.T. is to determine the mix on the basis of qualifications. The alternative is a plan which asks each student receiving financial aid, whatever his need or academic promise, to take a fixed amount of his total as a combination of loans and jobs each year. His additional needs are then met by scholarships. Scholarships lose some force as a recognition for achievement, but every student knows that his loan obligation will be no greater than his classmates'.

The Productivity Problem

Two years ago William G. Bowen, Professor of Economics and Public Affairs and Provost at Princeton University, forecast in a special report to the Carnegie Commission on Higher Education that for the decade ahead the cost of education per student in the major private universities would rise at the (compound) rate of 7½ per cent a year. Viewing their overall prospects for expenses and income, Dr. Bowen predicted that "the economic squeeze already being felt by the major private universities is going to intensify greatly."

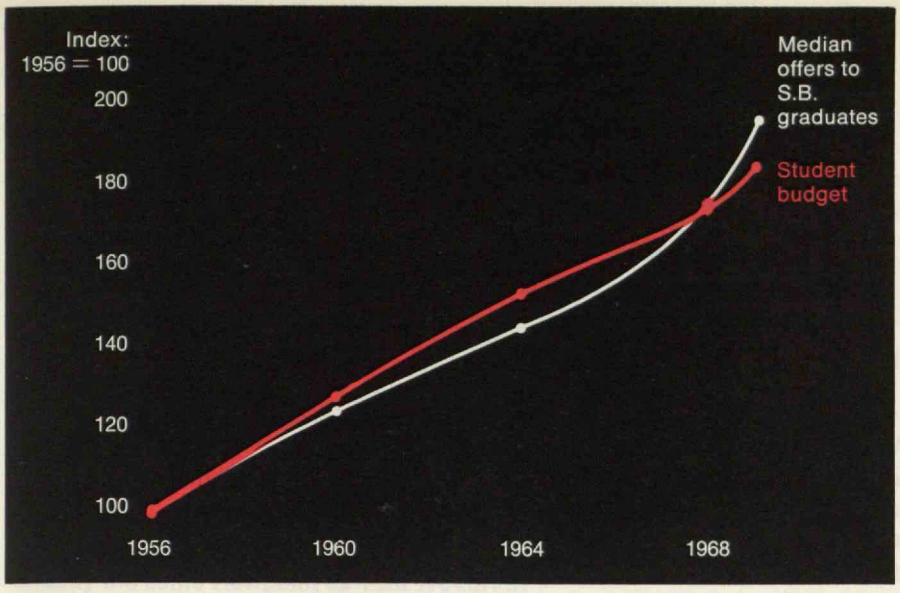
Figures published by M.I.T. officials in connection with the announcement of an increase in tuition to be effective in June, 1970, demonstrate the reliability in M.I.T.'s experience of Dr. Bowen's projections and conclusions.

M.I.T.'s new tuition will be $2,500, a $350 increase. The change continues a pattern under which Institute tuition has grown at a compound rate of just over 6 per cent a year since 1956—keeping pace almost exactly with the rate of change in the cost of the Institute's teaching activities (not including administration, maintenance, and research).

Several factors were joined in Dr. Bowen's predictions to cause university educational expense to increase more rapidly than the general price level in the U.S. He cited the broadening of curricular offerings—"doing something more than just studying traditional subjects in traditional ways;" the universities' increasing responsibilities to community, state, and nation; advances in knowledge and technology which have made libraries larger and such things as computers, now indispensable to higher education, increasingly expensive; and the increased emphasis on research and other relatively expensive educational techniques.

What new technology can do for industry it has not done for education. Indeed, though it represents a chief source of new productivity for business, new technology is the chief source of new costs in education. For example, wrote Dr. Bowen in his report, "by permitting new departures in research and teaching, computer technology (itself a new expense for universities) has meant increased costs, not cost savings." Dr. Bowen called this the universities' "productivity problem"—the fact that technology's effect on the university is very different from its effect in industry.

It was on the basis of factors such as these, said Howard W. Johnson, President of M.I.T., that he and the M.I.T. Corporation "reluctantly" made the



While the cost of their college experience has been rising at a remarkable rate, so have the fruits of it as paid to M.I.T. graduates upon taking their first jobs, according to figures developed by Institute officials in connection with a tuition increase announcement made this summer. The "student budget" figures as calculated by the Institute's Student Aid Center include tuition, dormitory room and board, books, health insurance, and an allowance for personal expenses.

tuition decision. "The inevitable alternative to increased tuition in a period of rising costs must be lowered quality," he said. President Johnson noted that many other institutions had recently raised tuition and that some had come to a policy of annual increases to keep pace with their costs. "M.I.T. as well must consider that possibility for the future," he said.

"I consider it my overriding obligation to maintain—and advance—the quality of an M.I.T. education," President Johnson wrote.

To offset the effect of the tuition increase, proportionate increases will be made in student aid funds (*see left*), and greater use will be made of the Federal Guaranteed Loan Program. In connection with the tuition announcement, M.I.T. also developed figures to show that the starting salary offers to M.I.T. graduates with bachelor's, master's, and doctor's degrees have grown since 1956 at least as rapidly as the average M.I.T. student's budget, including tuition, as figured for financial aid purposes by the M.I.T. Student Aid Center.

Is C.B.W. Hurting the Country?

Is it possible that the United States is doing itself more harm than good with its present chemical and biological warfare (C.B.W.) policies and programs? A growing group of scientists are becoming concerned about C.B.W., and one of them, Matthew Meselson, Professor of Biology at Harvard, believes that the answer is yes.

Professor Meselson has served as a consultant to the Arms Control and Disarmament Agency, and he testified on C.B.W. before the Senate Foreign Relations Committee in April. Now he is working with a group of M.I.T. and Harvard students and faculty to gather a portfolio on the history and nature of C.B.W. and current U.S. policy on it. Aim: to make readily accessible to the public information on what may be one of the most important issues of the century.

In grossest terms Professor Meselson's argument is this: Unless the U.S. takes positive action to limit use of chemical and biological weapons and becomes a formal party to agreements barring their use, 10, 20, or 30 years from now we may live in a world where small as well as large nations will be able to destroy the civilian populations and environments of other nations through chemical or germ agents.

The Geneva Gas Protocol

To date, some 70 nations have signed the world's oldest binding international arms control agreement: the Geneva Protocol of 1925 prohibiting use of chemical and biological agents as first-strike weapons. The agreement is considered binding by all countries which have ratified it; but six signing nations, including the United States, Japan, and four Latin countries, have not yet done so.

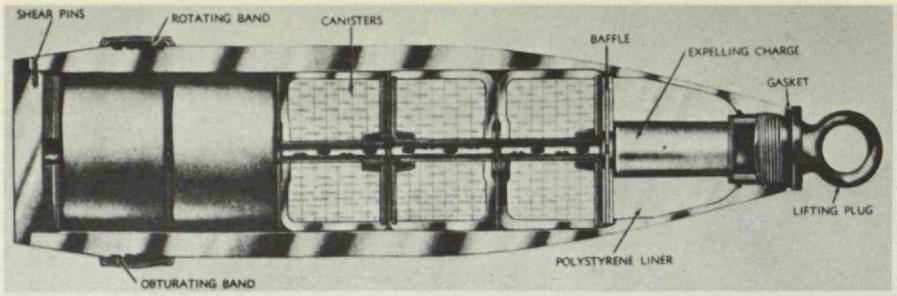
Professor Matthew Meselson of Harvard *(see left)* testified before the Senate Foreign Relations Committee in April on the necessity for U.S. ratification of the Protocol:

"If you come to the decision that you want to keep out of this business unless somebody pushes us into it, you should implement that decision in the form of a treaty obligation that is lasting . . .

"The Geneva Protocol is a no-first-use treaty. It does not outlaw research, development, or production of gas or biological weapons. It does not outlaw retaliation in case one is attacked.

"I think we do ourselves far more harm than good by stimulating interest in these weapons, by breaking down the barriers against them."

The U.S. now uses large quantities of gas to increase the effectiveness of fighting in Vietnam. But this policy could prove fatal to existing controls on chemical warfare already observed by other nations. Shown here is one of the weapons used to disperse the gas CS; it is a XM-631 155 mm. tactical CS projectile, 60.4 cm. long. (Photo: U.S. Dept. of the Army Training Circular 3-16, 1969)



C.B.W. in Vietnam

Matthew Meselson, Professor of Biology at Harvard, believes that the little-known but extensive U.S. use of ochlorobenzalmalononitride (CS)—an eye and lung chemical irritant—in Vietnam "tears a big hole in the psychological wall which has prevented global spread of chemical and biological weapons for 50 years."

Unclassified Army figures show that the U.S. has sharply increased the amount of CS used in Vietnam since 1965. More than half of the Army's total procurement of CS was in the last year. The Army's arsenal of weapons for distribution of tear gas has increased in number and size. According to a recent article in the *Washington Post,* Professor Meselson has calculated that, since 1964, the Army has bought enough CS to cover every square mile of South Vietnam, with some to spare. Thus, concludes Professor Meselson, "Most of the CS now being purchased is for use to increase the effectiveness of conventional military operations, as was stated by Secretary Rusk in 1965."

Chemical weapons have not been used in a major conflict (only reportedly in two minor ones) since World War I, when the French and Germans used large quantities of non-lethal gases leading to the lethal German chlorine attack at Ypres and the subsequent escalation of all-out gas warfare. Since then, however, the case of C.W. is unique as a story of remarkable global restraint in the application of a new weapon for which the technology has been available.

There are several important misunderstandings about chemical and biological weapons, says Professor Meselson:

1. *C.B.W. is more "humane" than conventional warfare.* But the record of World War I and Vietnam shows clearly that in actual combat tear gas and other "non-lethal" chemical weapons are used in close conjunction with conventional weapons to increase the lethal effectiveness of the latter—for example, in Vietnam, tear-gas is used before opening fire so that enemy gunners will miss their targets and be driven from protective cover.

2. *Special international prohibitions on C.B.W. are not essential to national security.* But C.B.W. is unique; it resembles nuclear war much more than conventional war in its threat to civilians, but the costs of development would be markedly less. Moreover, development of C.B.W., unlike other weapons, vastly risks increasing the destructive powers of other nations while not significantly increasing our security.

3. *Since the enemy has it, we have to have it.* But other weapons that the U.S. already possesses are superior for deterrent and retaliatory purposes. And the long term cost to us of maintaining an offensive C.B.W. capability is the risk of proliferation among other nations, especially non-nuclear ones.

4. *We need these weapons in order to learn how to defend ourselves from them.* While it is true that a certain amount of research and investigation of defensive tactics is wise, this is no basis for stockpiling these weapons, as we in fact now do.

The most important step the U.S. could take now would be to ratify the 1925 Geneva Protocol, a treaty drawn up by the United States and since then ratified by some 70 nations including all the other N.A.T.O. partners, the U.S.S.R., and the People's Republic of China, "This," he says, "would give an enormous boost to C.B.W. arms control."

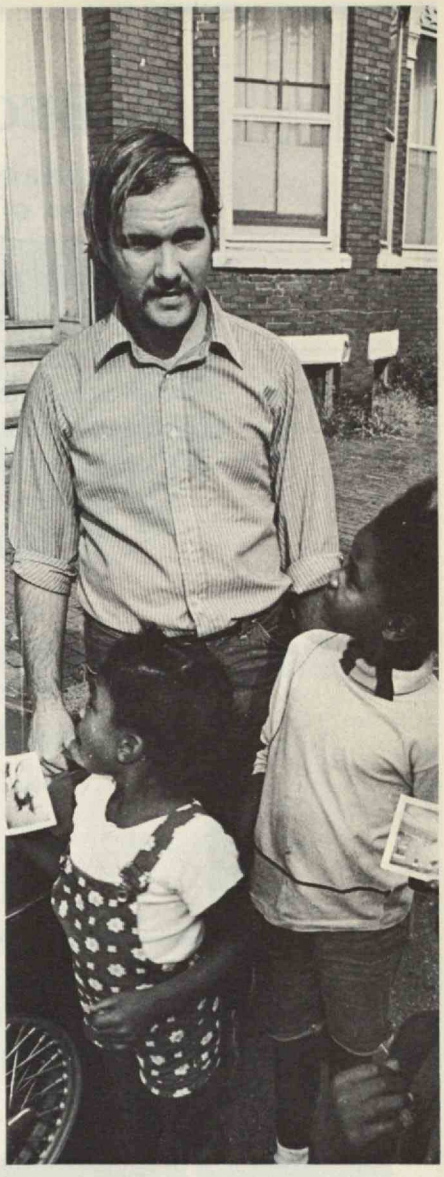
Management and the Student Revolution: Meet Tom W.

Clean-shaven (except for a moustache), grades good (not perfect), and very much on the go, Tom Woodruff could easily be suited, tied, cufflinked (slide rule in his pocket) and labeled: "The Model M.I.T. Man: Student and Force in Community Affairs—how does he do them both?"

But he's not the model M.I.T. man, and he thinks that doing both is almost too much. He finds it fortunate that his major relates to his extra-curricular life. The name of his curriculum major is management; the name of his other major is a $56,000-a-year program centered at M.I.T. which directly affects more than 1,100 people: Urban Action.

Urban Action is a loosely structured, executive organization which enlists student labor—both as paid workers and as volunteers—to work for neighborhood groups and for Urban Action's own community projects. Not limited to Cambridge, Urban Action has projects also in Boston's Roxbury and South

The new college animal is Tom Woodruff, part management student, part community worker. Here he is shown with some of his colleagues in front of his apartment in the Model Cities neighborhood of Cambridge, from which he commutes every day to the campus. (Photos: Owen D. Franken, '69)



End areas. Unlike the "typical" college stereotype centering around classroom and fraternity or dormitory life, Tom's work at M.I.T. and his involvement in community affairs are almost inseparable. He lives off-campus in the Cambridge Model Cities neighborhood a few blocks from M.I.T. Many of his friends are the local parents of children being helped by Tutoring Plus, one of U.A.'s biggest Cambridge education projects. And his close student friends are also people who commit a fair share of their week to neighborhood work. Tom is only one of a growing number of students for whom "curriculum" is an administrative device and "education" is *everything*—including, of course, serious classroom work.

Urban Action tangles with many tough community issues, including the critical one of the housing shortage in Cambridge, which is caused—in part—by the presence of large student populations of the two big universities. And, while M.I.T. is also working on these issues, it does not always have exactly the same viewpoint as Tom Woodruff.

What is it like to be a representative of M.I.T. who does not represent M.I.T.—officially at least?

In theory, Tom explained, there are problems of policy posed by the fact that neighborhood groups—many of which can hardly afford clerical help—can get M.I.T. student brains and energies, often free of charge, through Urban Action. But the representation question rarely becomes an issue in practice.

This summer, in fact, one Urban Action worker, a junior, found herself calling M.I.T. in order to negotiate the use of an M.I.T.-owned building as a local teen center. Another worker, researching the Cambridge School Committee campaign of a candidate who favors rent control, found himself in a shouting match on the steps of City Hall with another M.I.T. student—this one representing another group which opposes rent control.

While Tom Woodruff works for the betterment of the Cambridge and Boston neighborhoods, he also has one eye trained on M.I.T.

"A long term effect of Urban Action may be the clarification of M.I.T.'s institutional role in nearby urban communities," he believes. "At a time when universities across the nation are trying to define the involvement they should have in the urban crisis, the Urban Action program may provide, on a small scale, a model for what that involvement should be." This was one sentence in Tom's 57-page annual report this year.

Concerning education, Tom told *Technology Review:* "We hope we are finding something out about how to teach socially-related courses in the urban field. We feel that they should be to some extent experience-based. This exists already in the sciences, but not yet in the social sciences."

On town-gown relations: "Educated people are welcomed as helpful friends by local groups, and sometimes as leaders—only when they have some *historical link* with the group of the neighborhood." But otherwise, college degrees do not necessarily leaders make. "Tutoring Plus wasn't nearly as far along two years ago, before six parents became its directors."

Finally, on student radicals: "It's easy to use stop tactics and pressure politics to call things to a halt. But if a student demands, say an urban studies program for undergraduates, and university replies, "O.K., what do you want in it?" most radicals will just reply, "Well, um, er . . ."

"It's one thing to tell M.I.T. to move in a certain direction. But I think that when you get a lot of people doing something, then M.I.T. will be moving."

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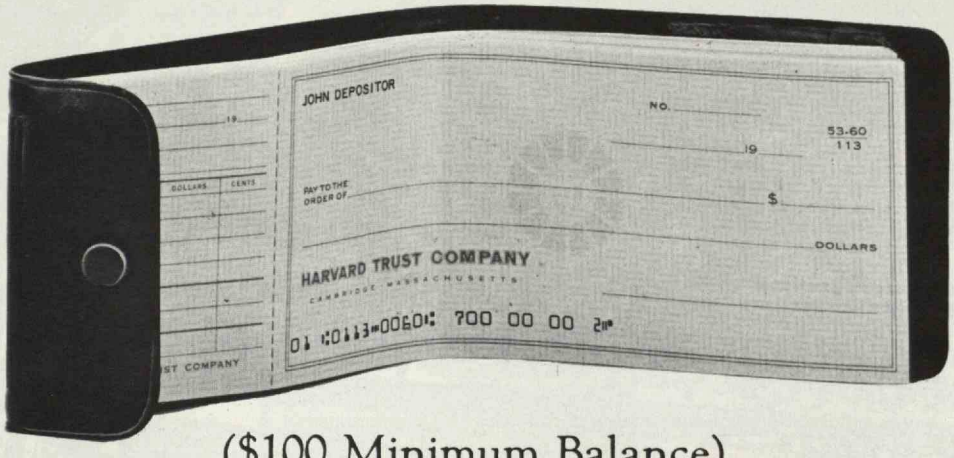

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Institute Review

Alumni Fund: "Sustained Performance," New Records

New records of $2,680,077 in gifts from 19,829 donors have been posted by the 1969 Alumni Fund. The Fund's achievement brought total alumni giving to M.I.T. in 1968-69 to a record total of $13,120,133.

Howard L. Richardson, '31, Chairman of the Alumni Fund Board, said in his annual report that "every alumnus can take pride in these accomplishments and what they represent."

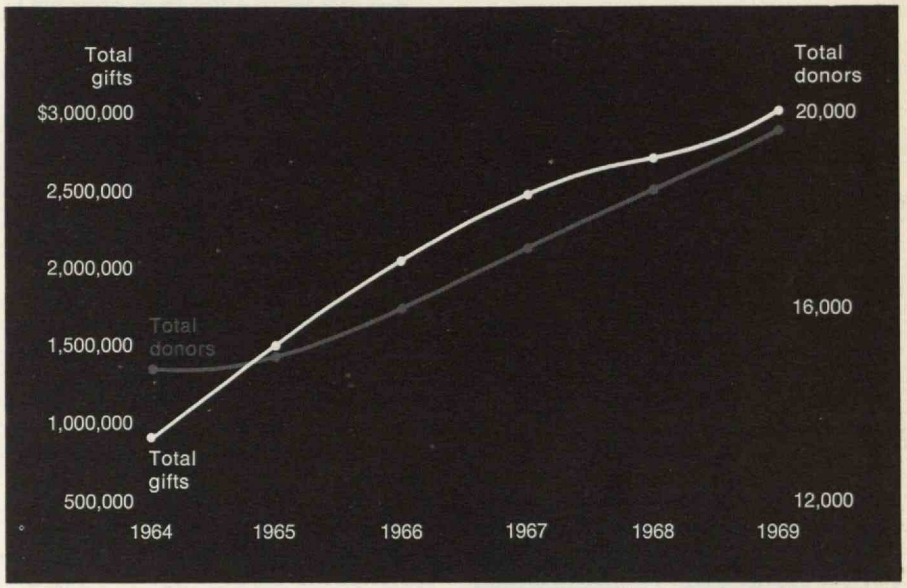
Clearly, he said, M.I.T. alumni have "an acute consciousness of the increasingly vital role of the Institute in our educational structure, the contributions of the Institute and its principal product—alumni—to the welfare of mankind, the tremendous responsibility to prepare men and women for a demanding society. "The resources represented by these results, and the additional resources they help stimulate," said Mr. Richardson, "are assurances that, as before, M.I.T. will continue to the fore."

An additional dividend for the 1969 Alumni Fund was its recognition by the American Alumni Council for "sustained performance" among all alumni funds of U.S. colleges and universities. A special trophy and a check for $2,000 were given to Kenneth S. Brock, '48, Director of the Fund, at the annual meeting of A.A.C. in New York City in July.

Of the total M.I.T. Alumni Fund gifts in 1968-69, 37 per cent were designated for academic departments, including professorships, 7 per cent were designated for scholarships and loans, and 7 per cent were earmarked by their donors for housing; 38 per cent of the gifts were undesignated or marked for general purposes.

The Class of 1935 (Leo M. Beckwith, Class Agent) led all others in gifts to the 1969 Alumni Fund with a total of $177,157, and graduate alumni of the Department of Chemical Engineering led their Graduate School colleagues with total giving of $121,055.

The Classes of 1909 (Henry K. Spencer, Class Agent) and 1911 (Oswald W. Stewart, Class Agent) led in Alumni Fund participation; 71 per cent of the living members of each were contributors to the 1969 Fund. Sloan Fellows from the Sloan School of Management led graduate colleagues in fund participation, with a total of 59 per cent. Other notable records were achieved by the Classes of 1920 (55 per cent—Percy Bugbee and Alan W. Burke, Agents) and 1951 (53 per cent—Fred J. Bumpus and Charles Hicken, Agents).



New records for numbers of donors and the amounts of their gifts have been chalked up consistently by the M.I.T. Alumni Fund since 1964. Hence the 1969 American Alumni Council award of $2,000 for the "sustained performance" of the Fund among all those throughout the U.S.

Another notable achievement was made by the Class of 1969 (James P. Truitt, Jr., Agent), 145 of whose members pledged gifts of $4,899 during the weeks before Commencement. These pledges and other gifts of the Class in the next three years will fund an annual Class of 1969 Seminar Series, according to Mark Mathis, Class President, the purpose of which will be "to bring to the campus men and women whose ideas and actions are making major contributions toward solutions of the problems facing contemporary American society.

Gifts of 1,478 alumni were matched by their employers—200 companies who gave a total of $121,492.

New Appointments

Nine appointments to the M.I.T. faculty and administration have been announced during the summer months. They are:

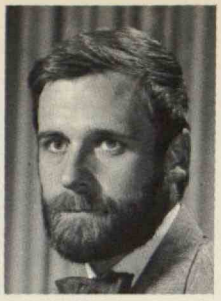
◇ Walter A. Rosenblith, Professor of Communications Biophysics who was Chairman of the Faculty from 1967 to 1969, and Paul E. Gray, '54, Assistant Provost and Class of 1922 Professor of Electrical Engineering, have been appointed to the new posts Associate Provosts, Jerome B. Wiesner, Provost, announced.

The two new posts were created because of the increase, in recent years, of the number of interdepartmental and interdis-

Dr. M. J. Kahne

Carl F. Floe

P. W. Cook, Jr.



J. Ingram, '58

ciplinary activities at the Institute, the Provost said. "It is my hope that the expanded staff of the Provost's Office will provide better support to these activities, especially to our programs in the urban field, in education, and in biomedical science and engineering."
Professor Rosenblith will be especially concerned with these fields, Dr. Wiesner said, while Professor Gray will continue with major responsibility for the undergraduate program and for innovative educational programs.

◇ Dr. Merton J. Kahne, Research Psychiatrist at the M.I.T. Medical Department since 1966, has become Psychiatrist-in-Chief, succeeding Benson R. Snyder, M.D., who was appointed Vice-President for Institute Relations last spring. Dr. Kahne, whose research combines interests in clinical psychiatry and sociology, studied at the University of Illinois and has been associated with McLean Hospital, Belmont, Mass., since 1956.

◇ Lincoln Clark, Associate Director of the M.I.T. Nuclear Reactor since 1966, has been appointed Director. He succeeds Theos J. Thompson, who left M.I.T. in June to be United States Atomic Energy Commissioner.

◇ Paul E. Johnson, Assistant to the Vice-President and Secretary of the Institute, has been appointed Associate Director of the Public Relations and Director of Campus Information Services. In his new capacity, Mr. Johnson will be responsible for "coordinating and strengthening channels of information within the Institute."

◇ Ronald S. Stone, '59, who has been an Industrial Liaison Officer since 1966, has been appointed Assistant Director of the Industrial Liaison Office. In addition, J. Peter Bartl, '67, and Jerome J. Schaufeld, formerly of the Instrumentation Laboratory, have been appointed Industrial Liaison Officers. Respectively, they succeed Karl B. Kehler, '65, and Carl H. Neu, '59, whose appointments as officers have been completed.

◇ James W. Lambert, Director of Planning at the School of Engineering at the University of Southern California, came to M.I.T. in August as Assistant Director of the Development Office. He studied at Pennsylvania State University and has had "wide experience in all phases of university development work," according to Vincent A. Fulmer, S.M.'53, Vice President and Secretary of the Institute, who announced the appointment.

◇ Two new assignments in the area of student placement have been announced. Robert K. Weatherall, formerly Assistant Dean of the Graduate School and Associate Director of Admissions, has been appointed Director of Placement. Edward J. Carey, Jr., Assistant Director of Placement with responsibility for directing the Office of Student Personnel, has been appointed Associate Director of Student Aid and Director of Undergraduate Employment.

◇ Herbert J. Gans, Visiting Professor of Sociology at Columbia University and author of *The Urban Villagers: Group and Class Life of Italian Americans* and *The Levittowners: Ways of Life and Politics in a New Suburban Community,* comes to M.I.T. this fall as Professor of Sociology and Planning in the Department of Urban Studies and Planning, formerly the Department of City and Regional Planning. Professor Gans, well known as a "scholar and critic of the urban and suburban scene," according to Lawrence B. Anderson, M.Arch.'30, Dean of the School of Architecture and Planning, has served as planner for public and private agencies and has taught at the University of Pennsylvania. His work has concentrated in community studies, urban poverty and segregation, and anti-poverty planning.

◇ David D. Lanning, Ph.D.'63, Manager of the Reactor Neutronics Section of Battelle Northwest Laboratories, has been appointed Professor of Nuclear Engineering. Professor Lanning was a member of the M.I.T. faculty in nuclear engineering and Assistant Director of the M.I.T. Reactor from 1962 to 1965. In his present post as Professor, he will also serve as chairman of a new Reactor Advisory Committee, Raymond L. Bisplinghoff, Dean of Engineering has announced.

Return to Teaching

Carl F. Floe, Sc.D.'35, Vice-President for Research Administration, has left his administrative duties to return to teaching as Professor of Metallurgy.

Professor Floe will continue as Chairman of the Committee on Copyrights and Patents. He will also continue to represent M.I.T. in several professional associations including Associated Universities, Inc., and the University Corporation for Atmospheric Research, and he will continue as a member of the M.I.T. Press Board.

M.I.T. activities which formerly reported to Professor Floe—the Departments of Aerospace Studies, Military Science and Naval Science, the Summer Session, Project INTREX, the Libraries, and the National Magnet Laboratory will report to the Provost, according to the announcement by Howard W. Johnson, President.

A New Stadium for Boston: Engineering Confronts Politics

Some 20 M.I.T. seniors jumped into the middle of a Massachusetts political hurricane this spring while undertaking a civil engineering projects study of a new stadium for Boston. And when it came time for their formal presentation, the atmosphere warmed sufficiently to attract A. S. Plotkin, the *Boston Globe*'s transportation and urban development specialist, from whose account in the *Globe* for June 3 the following is paraphrased.

In the format of previous engineering projects groups, the students divided themselves into two competing task forces to present alternative stadium designs and cost analyses. Each group designed a structure, analyzed costs and soil problems, anticipated revenues, and studied what to do about facilities now on the site; each talked with potential users of a new stadium—and with some of the potential customers.

Both BRAIN (Basic Research and Innovation, Inc.) and SIGMA (Stadium Investigation Group for the Metropolitan Area) proposed circular stadiums with movable seats. Both rejected the idea of roofs, either fixed or retractable, over the playing area.

BRAIN came up with a 53,000-seat structure estimated at $25 to $30 million. SIGMA proposed a 50,000-seat stadium

at $35 million at 1969 prices. Both proposed using the area of the Fort Point Channel, a little-used extension of Boston's inner harbor; BRAIN proposed filling the channel, while SIGMA put the stadium on stilts with a massive concrete mat 26 feet above the ground. On its raised field surface SIGMA would use a $750,000 carpet of "Astroturf," a synthetic fiber recommended to the students by the Boston Red Sox.

"They All Have Jobs With Us"

Interest at the students' presentation session in Kresge Auditorium centered on what Mr. Plotkin called the "not-so-young invited guests from Boston."

John Sears, a recent candidate for Mayor of Boston who identified himself at the session only as "a retired politician," asked, "What political body should float the bond issue?" To which John T. Driscoll, Chairman of the Massachusetts Turnpike Authority which wants to build a stadium and a third Boston Harbor tunnel to provide access, said, "Perhaps I can help them solve the political question. I will be happy to answer Mr. Sears' question."

Later Mr. Driscoll told the students he was "very impressed. I congratulate the professors and the two groups of students. We are very interested. If their figures can stand up, they all have jobs with us—that is, if we can resolve the political questions first."

Hugh Stubbins, a prominent Cambridge architect who is working on a new stadium for Philadelphia, questioned the students' cost figures which he calculated at $570 per seat. "I hope you can do it," he commented, "because that is about 75 per cent of the lowest cost stadium that has so far been built in this country." But he admitted that it is"terribly difficult to get accurate construction figures."

Mr. Stubbins also questioned the students' designs. A circular shape, he said, "is the worst you can build. It has the worst sight lines. . . . Look at the shape to bring the spectators as close to the activity as you can." But in the end he admitted the complexities of the students' undertaking and agreed that they had one "a great job."

Questions also came from William H. Tucker, former Chairman of the Interstate Commerce Commission (*see* Technology Review *for February, 1967*) who is now Vice President—New England of the Penn Central Railroad, whose land is directly involved in the students' stadium sites.

Analytical Studies Group

Staff support for administration and faculty in studies of M.I.T. policy, organization, and resource allocation will be provided by a new Analytical Studies Group in the office of the Vice-President, Organization Systems. The Group's Director, appointed during the summer when the Group was established, is Paul W. Cook, Jr., former President of Wabash College.

"The growth in size and complexity of M.I.T. requires the closest attention to the effective management of our resources," said John M. Wynne, S.M. '56, Vice-President, Organization Systems, in his announcement. The new Group, he said, "should contribute to the effectiveness of the Institute's administrative system for our faculty and students."

Funding was obtained through a Ford Foundation grant, one of a series given to colleges and universities in an effort "to improve the quality and effectiveness of management of higher education generally," said Mr. Wynne. Other portions of the same grant will support research in the economics and management of high education in M.I.T.'s Sloan School of Management generally under the direction of Leon S. White, Associate Professor of Management.

Three members of the new Analytical Studies Group were appointed this summer; they are Daniel F. Creasey, a specialist in financial and cost analysis; Robert H. Scott, '64, who will divide his time between the Group and his present assignment as Assistant Dean for Administration in the M.I.T. School of Engineering; and Paul V. Teplitz, '62, who completed studies at the Harvard Business School this June.

Dr. Cook, who studied economics at Brown and the University of Chicago, has held faculty appointments in the business schools of Harvard and University of Chicago.

Alumni Fund Appointment

Jeffrey J. C. Ingram, '58, has been named Associate Director of the M.I.T. Alumni Fund, where he will be concerned especially with class-related programs, such as reunion gifts, and with the development of graduate departmental organizations.

Following graduation from M.I.T. in mathematics and political science, Mr. Ingram studied political science at Columbia University and later received an M.A. degree in mathematics from the University of New Mexico. Most recently he has been Southwest Representative for the Sierra Club, a national conservation organization which has been broadly concerned with man's deteriorating environment.

Mr. Ingram has also worked as a field investigator for the New York State Department of Labor and at the Los Alamos Scientific Laboratory on Project Rover, a nuclear rocket program.

The Thames Challenge Upset

The Thames Challenge Cup was the event that "had everything" at the 1969 Royal Henley Regatta, says Jack H. Frailey, '44, M.I.T. Head Crew Coach.

Engineers, old (er) and new—members of of the 1954 Henley crew greet members of the 1969 crew on Alumni Day in June. At the left (front to rear): Jerome D. Waye, '54, Valdemar A. Skov, '55, Robert F. Buntschuh, '55, William H. McTigue, '54, Robert N. Sawyer, '56, Gordon J. Burrer, Jr., '55, F. Lawrence Holmes, '54, Leonard V. Gallagher, '54, and Robert D. Wilkes, '55. On the right (front to rear): Guillermo J. Vicens, '70, Donald M. Saer, '70, Bruce H. Parker, '69, Bruce Anderson, '69, Henry G. Baker, Jr., '69, W. David Lee, '69, Rodger E. Doxsey, '69, John M. Malarkey, '71, and Bryce W. McIntyre, Jr., '71. (Photo: Boston Globe)

The prospect of another meeting between Harvard and M.I.T., the arch-rivals from the Charles River, never materialized; Harvard was the only crew to beat the M.I.T. lightweights during their regular 1969 season. M.I.T. easily defeated University College of Dublin, the Canadian Argonauts, and the Kensington Rowing Club to reach the semi-finals, where both Harvard and M.I.T. were stopped; the Tech crew was never really in contention against the University of Pennsylvania freshman heavyweights who outweighed M.I.T. by 28 pounds per man. "The question of heavy freshmen against lightweight varsity was answered," Mr. Frailey noted in his report of the Henley for *The Oarsman,* the American rowing magazine.

Harvard fell to Leander in the other semi-final, and it was Leander in the finals—"a shock for us and a delight for the English . . . eliciting tradition-breaking words of praise from the Henley announcer," Mr. Frailey reported.

Engineering and Medicine: Blending Science and Humanism

Though by announced plan the 1969 M.I.T. Alumni Seminar was devoted to "new directions in medicine" attributed to technology, most of the discussion was aimed at convincing the 200 participants that the effects of technology must be less technical than human.
It is simply the case of a much more general problem, said Dr. Benson R. Snyder, a psychiatrist who is M.I.T.'s Dean for Institute Relations: "The large-scale application of technology to medicine is bound to have social consequences, and they must be understood."

"What is most important of all," said Dr. Snyder, "is to find a tracking device—to learn quickly whether we are on a sound long-term course." And if the students are impatient for such a device to chart the course of technology and of medicine, so are their teachers, he said.

In the meantime, the situation of the engineer trying to work with the doctor was described by Dr. Ivan L. Bennett, Vice President of New York University, as "affirmative bewilderment." The engineer's experience is a little like "watching a dance through a frosted glass"—the movement can be seen but the music cannot be heard and the people can't be identified.

The engineer, he said, must never forget that his medical technology must work on an individual.

Against this background, alumni attending the seminar heard details of a number of technological developments applied to medical problems—computers for scheduling health care by John F. Rockart, Assistant Professor of Management at M.I.T.; nutritional developments by Dr. Hamish N. Munro, General Foods Professor of Physiological Chemistry in the Department of Nutrition and Food Science; high energy X-rays for the treatment of malignancies by John G. Trump, Sc.D.'33, Professor of Electrical Engineering; the design of prostheses for handicapped people by Robert W. Mann, '50, Professor of Mechanical Engineering; and others.

Dr. Bennett expressed pessimism: today's medical practice is providing a high-priced service for which there is heavy demand; the result is little incentive to change. Innovation must come from outside the profession.

Yet the vision of change was held up to the seminar audience by Dr. Irving M. London, Professor of Biology, who described in some detail the plans for joint educational programs between the Harvard Medical School and M.I.T. The result, he said, will be several routes to M.D. or Sc.D. degrees involving various combinations of premedical, medical, engineering, and biological work. Out of this program—and of other parallel movements—there is now before us "the opportunity to educate a new type of physician who may revolutionize many aspects of medical care," said William M. Siebert, '46, Professor of Electrical Engineering.

Ho Ho Ho Chi Minh!

The focus of 200 alumni and their wives attending the 1969 Alumni Seminar (*see above*) was suddenly changed on Sunday night, September 7, from issues relating technology and medicine to those relating youth and nation. The result was a new experience for most campus visitors —and, indeed, for most members of the M.I.T. Cambridge community as well.

The President of the Undergraduate Association arrived at the Student Center, site of the Sunday evening Alumni Seminar dinner, early in the evening to complain that off-campus employees, rather than students, had been hired to serve the weekend meals. He stated the case for student employees, then reinforced his argument with a threat of action to disrupt the dinner meeting.

But even those who knew of the grievance were unprepared for the snake dance of 16 young people—mostly students—who entered the Sala de Puerto Rico to interrupt the paper by Dr. Hamish N. Munro of the M.I.T. Department of Nutrition and Food Science with the chant, "Ho Ho Ho Chi Minh, the N.L.F. Will Win!"

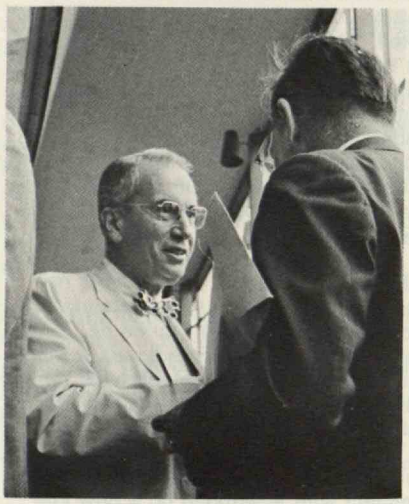
Unprepared to shift their subject so quickly—and for the incivility of the interruption—Dr. Munro's alumni audience responded with surprise and dismay and some—in the heat of the moment—with action. Within 10 minutes the meeting was recessed by Jack H. Ruina, M.I.T. Vice President who was Chairman of the Alumni Seminar Committee, the students departed, order was restored, and Dr. Munro resumed his address.

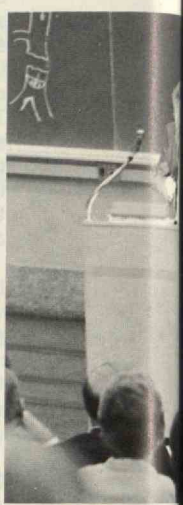
The confusion over objectives remained, with aggrieved students in the corridors outside claiming that the demonstration leaders had chanted the wrong chant, the leaders responding that nothing is so important as ending the Vietnam war, that until it ends there can be "no business-as-usual, no parties at M.I.T."

Some campus observers of the episode attached to it importance greater than its duration would suggest. They feared it was a rehearsal for new "hit-and-run" disruptive tactics by the radical student minority in which communication—and hence understanding—would be essentially impossible.

Had Dr. Benson R. Snyder, M.I.T.'s new Dean for Institute Relations, described the symptoms in his address to the Alumni Officers' Conference on the previous day? The campus in danger of losing its "cool," he said, becomes increasingly polarized, a "supersatured solution" where "assumptions cannot be examined—simply argued," where "communications become simply a line between camps."

At the opening luncheon (opposite page, top), M.I.T.'s President Howard W. Johnson characterized the 1969 Alumni Seminar as "a learning exchange . . . in which all are students, all are teachers, and all learn from each other." The Seminar topic, he said, was "a natural area of concern, in which it is difficult to overestimate the growing interest and commitment of M.I.T. faculty and students." Later Dr. Ivan L. Bennett (lower right), Vice President of New York University, agreed to the urgency of the subject but called the engineer's experience in trying to penetrate medical problems a kind of "affirmative bewilderment." But just as the engineer's success in reaching the moon marks the end of an era, said Dr. John H. Knowles (this page, bottom), Director of Massachusetts General Hospital, so will a full realization of the gains of science through medicine for people everywhere mark the next great epoch of progress by technology. ((Photos: Owen D. Franken, '69)





Of "Obsolete Relics," "Senioritis," and Other Points of Dislocation

In *Technique 1969,* M.I.T.'s student yearbook, John S. Saloma, III, '56, Associate Professor of Political Science (*see next page*), finds M.I.T. at a moment of transition, "reluctant to call itself a university of the past, predestined to be a new university of the future, perhaps the archetypal institution of the coming age."

Their effort to document the Institute in this instant of change led the editors of *Technique* far afield from the traditional, saccharin school yearbook with groups of smiling faces and stolen pictures of collegiate bliss. The new book, published at the close of the 1968-69 school year, presents instead a generous collection of essays and photographs which bear sharply on the decisive issues and points of dislocation at M.I.T. in 1969.

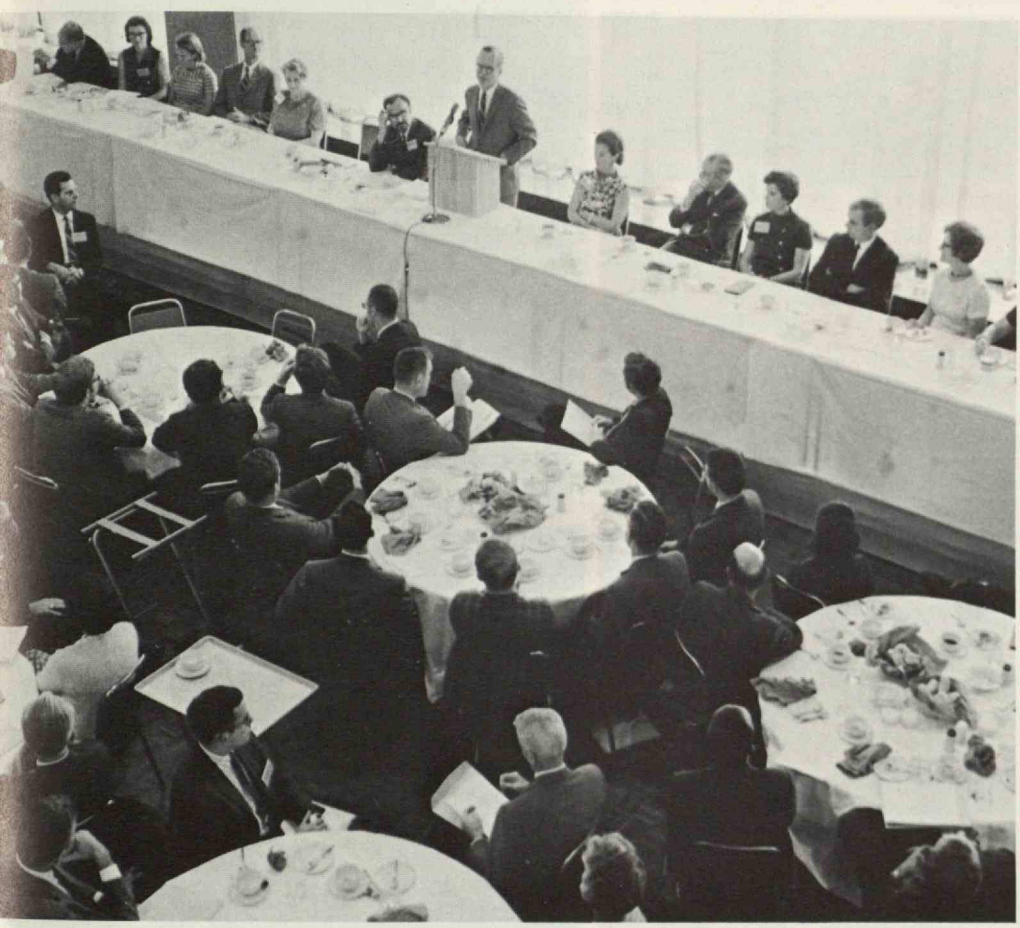
Examples, in addition to the essay by Professor Saloma:

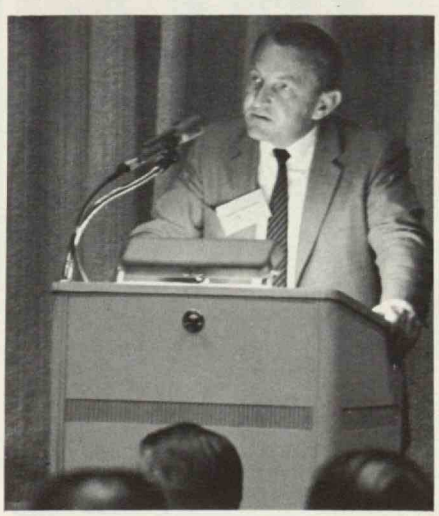
Kenneth A. Finder, '71, on "The Conscience of the Scientist," a character study of Philip Morrison, Professor of Physics: "The scientist is in a unique position with regard to the practical implications of his work. His knowledge and experience could make him a valuable judge of the benefits and dangers inherent in scientific discoveries . . . The narrow-minded and socially-anaesthetized scientist not only ignores his obligation to society; he denies himself the privilege of being a partner in the human struggle. Only a scientist who is involved in his society can contribute to the safe and proper use of science."

Doing 6.01 Problems All His Life

"First Isn't Good Enough," by Michael E. Warren, '69: ". . . Even in the most basic engineering subjects more emphasis must be given to the creative aspects, to the agonizing failures as well as the great successes in the field, to the limitations as well as the extent of methodology. . . . It should not be necessary for a student to think about going to business school in order to quell the fear that he may be doing 6.01 problems all his life if he remains an engineer. This is a situation that must be corrected lest M.I.T. one day discover that it is no longer first."

Peter Q. Harris, '69, and Charles Mann, '72, on "The Pass/Fail Experiment:" "Pass/fail is intended to remove some of the tremendous and soul-consuming pressure that M.I.T., M.I.T. students, and grades generate. The existence of grades encourages working for grades alone; working for grades, in turn, encourages single-minded devotion to academics and a resulting loss of perspective. . . . The grading system has been changed, but if the full range of possibilities for communications between faculty and students, the rich variety of extracurricular experiences, and the opportunities for developing realistic standards are not utilized in a responsible way by both students and faculty, the success of the experiment will be small."





From "Better the Bronx Zoo" (an essay on the M.I.T.-Wellesley exchange) by Albert M. Harlow, Jr. '70: "It is comforting that M.I.T. as an institution has the same feeling about Wellesley as a college that the Tech man has about his Wellesley date. Concerned about its own appearance, and hesitant to open itself to Wellesley, M.I.T. has nevertheless embarked on a five-year experimental exchange program. M.I.T. Chief Psychiatrist (now Dean of Institute Relations—ed.) Dr. Benson Snyder has compared Wellesley to a garden where seeds are planted and whatever comes up is an education, but the garden itself never changes. M.I.T., he suggests, is more like a shop where students can be fine-tuned. Can generalities find true happiness with specifics?"

Nutty Putty or Black Box?

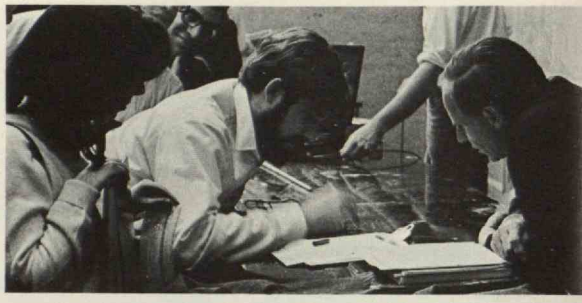
Steve Kaiser, '65, on "The Graduate:" "The set habits of graduate students means that they are fairly reliable and predictable in their work habits and require less supervision than their undergraduate counterparts. The faculty has found, however, that the established nature of these habits makes graduates less interesting to teach than undergraduates. Where the undergraduate is like an erratically bounding piece of Nutty Putty, the graduate student resembles a highly efficient and predictable black box."

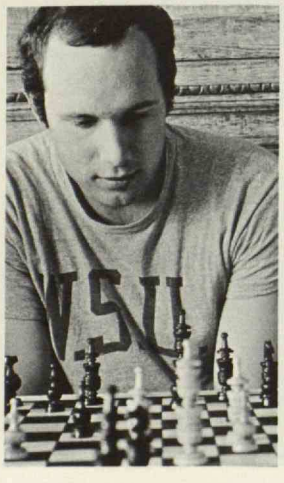
Stephen J. Grant, '70, on student publications: "Perception of the characteristics of media is an art of reasonable sophistication at M.I.T. Some of the media are frighteningly advanced; others are making mistakes, but learning; a few still insist on sailing along blindly."

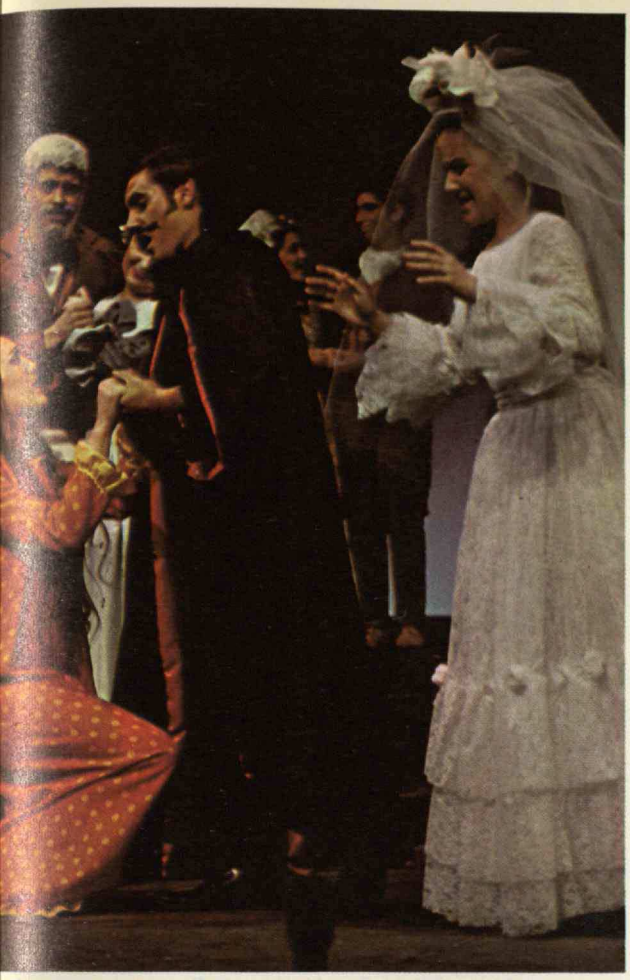
A definition of "senioritis," by Michael S. Meyers, '69: "The afflicted senior stops attending classes, he quits doing assignments or reading course material, and he may spend considerable time reading, daydreaming, or working on projects of his own. Particularly during the second term, when grades don't count nearly as much, seniors tend to find themselves without interest in their school work, and they also discover that they have not developed any other interests; as a result they lapse into a state of total withdrawal . . .

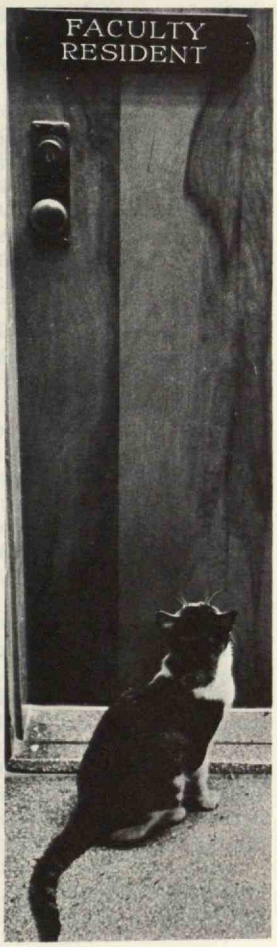
"But senioritis, as described here, may soon be a thing of the past. Few students can get through the undergraduate education now without encountering programs both at the Institute and in the community which demand the application of all the productivity available. . . . New courses in many fields are developing programs of direct action. Students are moving from the library and the laboratory to the office and the street. Success is being measured in terms of lasting social achievement as well as self-improvement. Seniors of the future may be so involved in their courses that they will never have time to lose interest in them."

In Technique 1969 *John S. Saloma, III, '56, Associate Professor of Political Science, describes M.I.T. as "perhaps the archetypal institution of the coming age." Its effort, he writes, must be "to find unity in a world of increasing diversity and possibility," to question "its commitment to public service if not its credentials for almost certain leadership." (Photos: 1969* Technique *by Bruce E. DePalma, '58, Richard M. Koolish, '68, Shohei Moritani, '72, Alfred I. Anderson, 3rd, '71, and Douglas G. Schumacker, '72)*









Answering Historic Questions

The following are excerpts from an eassy by John S. Saloma, III, '56, Associate Professor of Political Science, published in Technique 1969:

"M.I.T. today stands somewhere between two significant points of time and institutional development—between 'Tech is Hell' and a not-so-visionary university-city of the future.

* * *

"But for today's students, the 'now generation,' both the traditions of the old M.I.T. and the emerging significance of the future university are equally difficult to grasp. Past practices and past institutions have no validity in themselves. They must meet the test of relevance to the present. A future that is longer than an undergraduate's stay at the Institute seems equally without meaning. The current M.I.T. student generation shares the radical questioning spirit of youth everywhere.

* * *

"The older M.I.T. community, and especially the alumni, should not mistake the new spirit for a destructive revolutionary force. The failure in communication between the generations has bred a certain fear of the unknown and the incomprehensible. This is our common loss. . . . Students and the constantly changing input of young ideas and idealism cannot help but leave a significant imprint on the institutions through which they pass. Whatever other differences may separate the many generations of M.I.T. students, abundant energy, idealism, and an optimistic regard for man's potential to control his universe do not.

"As science and technology have become central facts of our society, M.I.T. has moved from a peripheral to a central position controlling many of the most important opportunities for entrance into the elite positions of the future. The implications of this reality are far-reaching. . . . The responsibilities of such power in a democractic society increasingly dependent upon technology and science raise historic questions of moral and political philosophy. It will not be an easy task to shape appropriate answers.

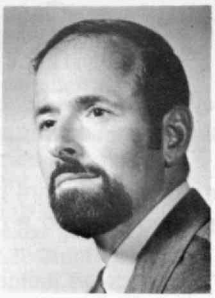
* * *

Radical students and faculty have been raising fundamental questions about the course of the Institute—questions that demand our serious attention. . . . The pressures continue for new M.I.T. academic commitments to fields such as education and medicine, supported by steady undergraduate pressure for a more diversified educational experience. . . . The professional demands on faculty have increased steadily at the same time that restrictions and internal constraints of the undergraduate program have decreased. The new freedom (or permissiveness) in undergraduate education has made possible . . . new possibilities for pre-professional training. . . . The burden of defining an adequate undergraduate educational experience has shifted gradually from the Institute and a structure of general requirements to the individual student.

* * *

"The M.I.T. of 1969 as one alumnus sees it (is) at the threshold of a new era; reluctant to call itself a university of the past, predestined to be a new university of the future, perhaps the archetypal institution of the coming age; struggling to find unity in a world of increasing diversity and possibility; questioning the meaning of its commitment to public service if not its credentials for almost certain leadership. It is a time to put aside fear and to learn humility from each other about ourselves, our past, and our present. It is a time to be proud to be sons of M.I.T."

Luther Davis



R. P. Sonnabend

Individuals Noteworthy

To *Roger P. Sonnabend,* '46, President of the Hotel Corporation of America, the honorary LL.D. degree from the University of New Hampshire . . . To Captain *Roger G. Mark,* '60, the Air Force Research and Development Award for outstanding achievement in biological research during 1968 . . . To *Manson Benedict,* Ph.D.'35, Head of the M.I.T. Department of Nuclear Engineering, the 1969 Arthur Holly Compton Award of the American Nuclear Society.

To *Ajay K. Bose,* Sc.D.'50, the Ottens Award for outstanding research conducted in 1968-69 at Stevens Institute of Technology . . . The "Citizen of the Year" Award of the Milton, Mass., Town Club to *David Jeffries,* S.M.'51 . . . *Luther Davis, Jr.,* to General Manager of the Research Division, Raytheon Company (Waltham, Mass.) . . . The Extraordinary Service Award of the Federal Aviation Administration to *Raymond L. Bisplinghoff,* M.I.T. Dean of Engineering, adviser on the supersonic transport.

Simplex Purchase

Agreement for M.I.T. to acquire the Cambridge property of Simplex Wire and Cable Co. upon the Company's transfer of its operations to a new site in North Berwick, Maine, was announced in Cambridge during the summer by Joseph J. Snyder, '44, Vice President and Treasurer of the Institute.

The site, a total of 800,000 square feet, is adjacent to the M.I.T. campus, west of Massachusetts Avenue and north of the Boston and Albany railroad tracks.
In his announcement of the purchase plans, Mr. Snyder said that "M.I.T. is acquiring the property as a resource for making further contributions to the construction of urgently needed new housing in Cambridge and not for the expansion of M.I.T.'s academic campus. It is M.I.T.'s intention also to bring about new commercial development on the site that will add significantly to tax revenues and employment opportunities in Cambridge. All expected uses of the site will be taxable," he emphasized.

"We believe that proper development of this site presents an unusual opportunity to increase the housing supply in Cambridge beyond programs already planned," Mr. Snyder said.

"Part of the site will be devoted to new, taxable, commercially-financed housing for M.I.T. faculty and other Institute personnel with the expectation that this should help reduce pressure on existing housing in Cambridge. There is no housing now on the site, and the new housing will be in addition to the program of public and private housing in Cambridge that M.I.T. proposed in April.

"The site also presents an opportunity to add substantially through new commercial development to the tax revenues and to the number and variety of jobs in Cambridge. Our preliminary analysis indicates there is good potential for new business development here. The property, as it now stands, represents a tract of underdeveloped land that should, once it is converted from its present obsolescent use, be more productive in revenue and in jobs for the city."

Simplex Wire and Cable Co. announced in April its plans to move out of Cambridge in 1970 because of the severe economic disability of operating in an obsolete plant.

Alumni Appointments

Eighteen alumni are among those recently receiving junior faculty or administration appointments at M.I.T.:

Barry A. Blesser, '64, Assistant Professor and Postdoctoral Fellow in Electrical Engineering
George S. Boolos, Ph.D.'66, Assistant Professor of Philosophy (Department of Humanities)
Louis B. D. Braida, S.M.'65, Assistant Professor and Postdoctoral Fellow in Electrical Engineering
James D. Bruce, Sc.D.'60, Executive Officer of the Department of Electrical Engineering
James D. Callen, Ph.D.'68, Assistant Professor of Aeronautics and Astronautics
Renwick E. Curry, '61 Assistant Professor of Aeronautics and Astronautics
James W. Gosnell, Ph.D.'69, Assistant Professor of Nuclear Engineering and Assistant Director for Operations of the M.I.T. Reactor
Jonathan W. Green, '62, Assistant Professor of Architecture
William J. Ince, S.M.'65, Assistant Professor of Electrical Engineering
Ralph L. Keeney, '68, Assistant Professor and Postdoctoral Fellow in Civil Engineering
Steven Kleiman, '61, Associate Professor of Mathematics
Stephen G. Kukolich, '62, Assistant Professor of Chemistry
Milton L. Lavin, '60, Assistant Professor of Management
Geoffrey Margolis, S.M.'65, Assistant Professor of Chemical Engineering
Roger G. Mark, '60, Assistant Professor of Electrical Engineering
Neil E. Todreas, Sc.D.'66, Assistant Professor of Nuclear Engineering
Ronald A. Walter, '63, Assistant Professor of Urban Studies and Planning
Ian T. Young, '65, Assistant Professor and Postdoctoral Fellow in Electrical Engineering

Alumni Calendar

Bethlehem, Pa.—November 5, Wednesday, 8:00 p.m.—Evening meeting at Whittaker Laboratory, Lehigh University. Speaker: Frederick H. Martin, Technical Director, Instrumentation Laboratory, M.I.T. Topic: Apollo 11 and the findings based on the Apollo 11 moon landing.

Boston
October 9, Thursday, 12:15 p.m.—Luncheon, Union Oyster House, 41 Union St. Speaker: Representative George Sacco, Vice Chairman of the Massachusetts House Ways and Means Committee. Topic: Taxation in Massachusetts.

October 23, Thursday, 7:00 p.m.—Buffet dinner, Boston Museum of Science. Speakers: Bradford Washburn, Museum Director, and D. Reid Wheedon who will speak briefly on the role of the Museum in the community. A tour of museum exhibits and a special showing at the Charles Hayden Planetarium will conclude before 10:00 p.m. so that children may enjoy this event.

November 13, Thursday—Luncheon, Union Oyster House. Speaker: William F. Pounds, Dean of the Sloan School of Management, M.I.T. Topic: defense research at M.I.T.

Denver—October 24, Friday, 6:30 p.m.—Dinner, Petroleum Club. Speaker: Irwin W. Sizer, Dean of M.I.T.'s Graduate School. Topic: Molecular biology and medicine.

Hartford-Springfield—November 21, Friday. Joint meeting at Chez Joseph Restaurant, Hartford. Topic: city problems and inner city planning.

Long Island—November 15, Saturday, 7:00 p.m.—Dinner dance at McLaughlin's in Roslyn. Speaker: Ernest A. Steinhoff, Chief Scientist, Holloman AFB, N.M. Topic: Extra terrestrial resources luring the space explorers; slides of Apollo 11.

Los Angeles—November 11, Tuesday—Dinner meeting. Speaker: George Sullivan, General Electric Company, Philadelphia. Topic: Undersea technology.

Newark—November 6, Tuesday, 6:30 p.m.—Dinner, Atomic Energy Commission, followed by a debate. Topic: Is the ABM technologically, economically and politically feasible? Speakers: Pro from the Department of Defense; Con from New York State University, Stony Brook.

New York
October 6, Monday, 5:30 p.m.—Cocktail party for recent graduates, from the Class of 1955 through the Class of 1969, in the Music Room, Biltmore Hotel.

October 21, Tuesday, 12:15 p.m.—Luncheon, Nichols Room, Chemists Club. Speaker: Chancellor Albert H. Bowker, '41, City University of New York.

Philadelphia—October 28, Tuesday, 6:30 p.m.—Dinner, Museum of the University

of Pennsylvania. Speaker: George Ernest Wright, Parkman Professor of Divinity and Curator of the Semetic Museum at Harvard University. Topic: Archeology in the Holy Land.

Portland, Maine—October 23, Thursday 6:30 p.m.—Dinner, Holiday Inn Restaurant. Speaker: Frederick H. Martin, Technical Director, Instrumentation Laboratory, M.I.T.

Rochester, N.Y.—October 22, Wednesday, 6:30 p.m.—Dinner, University Club, Pine room. Speaker: Howard Samuels, '41, Director of the Rochester Small Business Agency. Topic: Experience of a businessman and an M.I.T. alumnus in public service.

Springfield, Mass.—November 21, Friday, 6:30 p.m.—Joint dinner meeting, M.I.T. Club of Hartford and the Springfield and Hartford Wellesely Clubs, Chez Joseph Restaurant. Speakers: Professor Stephen London of Wellesley and an M.I.T. professor. Topic: Inner city problems and planning.

Washington, D.C.—October 20, Monday, 7:00 p.m.—Hayride and cookout for alumni and families at Camp Waredaca, Green Hills, Md.

Class Reunions—June 12-14, 1970.

Homecoming—June 15, 1970.

Alumni Deceased

Richard H. Mansfield, '92, n.d.**
Charles M. Stamp, '96, February 10, 1961
William Binley, '97, June 8
Batista P. Sanchez, '99, n.d.**
Austin T. Hyde, '01, June 4
George L. Mitchell, '01, July 27
Harry R. Low, '03, July 7
Robert F. Luce, '05, February 5*
E. Sherman Chase, '06, July 8*
Joseph T. Lawton, '06, n.d.**
Frederick C. Line, '06, May 26, 1967
Frederic Menner, '07, May 22
Emerson H. Packard, '07, February 23, 1965
Gregory M. Dexter, '08, July 20*
Major L. Hagood, '08, August 6, 1967
Henry V. Spurr, '08, May 3*
The Reverend Arthur E. Hartwell, '09, June 18
William B. Hargraves, '10, n.d.**
Joseph W. Northrop, '10, September 26, 1968
Clifford S. Redfield, '10, n.d.**
Samuel H. Cornell, '11, April 19
Charles W. Homeyer, Jr., '11, November 8, 1968
Maurice J. Lowenberg, '11, March 13
Charles Edison, '13, July 31*
Lindsley F. Hall, '13, January 27
Arthur E. Howlett, '13, May 3
A. Lawrence Kocher, '13, June 6
Harold D. Marsh, '13, April 28
Lucian W. Burnham, '14, June 26
Huang Chen, '15, n.d.**
Ming Chow, '15, n.d.**
Forrest G. Purinton, '15, July 14
Tsang-Kyien Yuan, '15, n.d.**
Laurence H. deLabarre, '16, July 25*
En Tseng Hsieh, '16, n.d.**
Theodore C. Jewett, '16, June 24*
L. Plitt Smeltzer, '16, July 7, 1968
Diwan N. Chand, '17, n.d.**
George I. Goodwin, '17, n.d.**
Harold J. McDonald, '17, n.d.**
Leslie S. Ray, '17, May 13
Claudius H. M. Roberts, '17, June 25*
Hsi C. Wang, '17, n.d.**
Harold N. Blount, n.d.**
Carlos Godino Gil, '18, n.d.**
Kwei L. Hsueh, '18, n.d.**
Julian T. Leonard, '18, August 15
Elwood H. Aldrich, '19, December, 1965
Mrs. Walter C. Hayden, '19, September 11, 1967
Cho-Pin Hsueh, '19, n.d.**
Shao-Yu Hung, '19, n.d.**
A. Stuart Kelsey, '19, May 23
Nai H. Leung, '19, n.d.**
Harold G. Pratt, '19, May 19
Chen Tan, '19, n.d.**
George E. Dill, '20, November 22, 1968
Lawrence B. Richardson, '21, July 6*
Thomas S. Craig, '22, April 27, 1968
James R. Norton, '22, November 18, 1968
Albert E. Page, '22, May 3
Jacob Teich, '22, February 26, 1968
Newman W. Field, '23, May 11
Joseph Fleischer, '23, June 10*
Charles S. Keevil, '23, July 19*
Edward G. Pierce, '23, February 11
Francis A. Rood, '23, February 11, 1963
Everett L. Sweet, '23, February 12, 1967
Thomas F. Bundy, '24, May 30
Edward B. Jennings, '25, July 26, 1968
John W. McAuliffe, '25, August 5, 1968
Thomas E. White, '25, October 2, 1967
Barrett C. Griffith, '26, April 28
Alfred J. Pote, '26, July 24
Edward F. Fletcher, '27, May 14*
Gerald P. de Westfelt, '27, November 14, 1968*
Mario A. Volante, '27, May 19*
Vincent R. V. Caputo, '28, April 22
John H. Foster, '29, May 3
Arthur B. Marsh, '29, January 9
Solon D. Boynton, '30, February 26
James S. Dadakis, '30, June 12*
Edwin V. Hill, '30, March 4*
Franz W. Bang, '32, August 19, 1968
Bruce G. Eaton, Jr., '32, January 1, 1968
John T. Odbert, '34, July 23
Hart L. Levingston, '35, December 21, 1968
Adolph G. Zwyner, '35, May 31
Ferdinand M. Humphries, '36, May 19, 1968
William B. Bunker, '37, June 5
John C. Hitt, '37, June 25
Arthur V. Hughes, '37, May 2
Edwards R. Fish, Jr., '39, June 30
Clinton D. Cook, Jr., '42, June 25
Ronald H. Smith, '43, March 21
Carmon J. Sciandra, '47, May 2
John J. Downing, Jr., '48, August 7, 1968
Joe L. Midgett, '48, September 9, 1967
George R. Pepin, '48, June 8*
Ronald L. Thompson, '52, September 5, 1968*
Igor A. Black, '54, April 20
Carlton W. Tillinghast, '55, July 27
Daniel D. Vappi, '55, May 30
Robert G. Lofgren, '58, April 17
Arthur R. Sprott, Jr., '58, January 10
Kenneth M. Fink, '59, June 17*
Jay E. Davidow, '67, February 16

* Further informtaion in Class Review
** Assumed deceased—mail returned to the Alumni Association

Kane on M.I.T.

the M.I.T. Calendar · 1969-70

1969

September 23 ~ Registration

October 4 & 5 ~ Seminar for Young Alumni

November ? Field Day ?

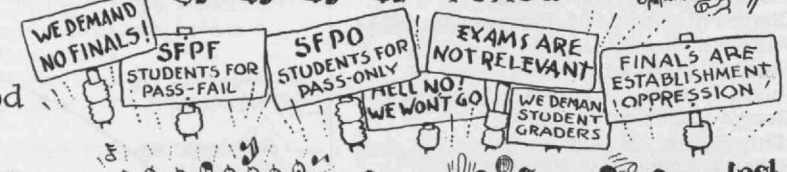
December 20 ~ Christmas Vacation begins

1970

January 4 ~ Christmas Vacation ends

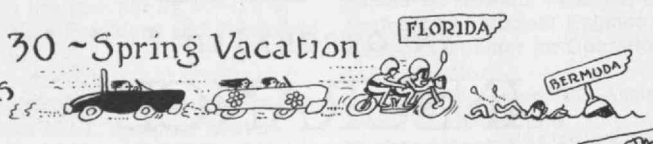
Jan. 19-21 Reading Period

January 22-30 ~ Examination Period

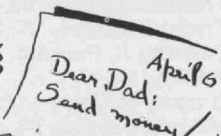


January 31 - February 8 ~ Mid-term Recess
Musical Clubs and Assorted Teams go touring

March 30 ~ Spring Vacation begins



April 5 ~ Spring Vacation ends

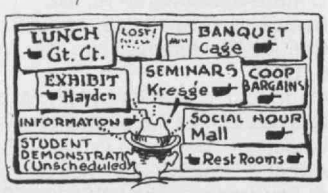


[Somewhere along here] ~ Spring Weekend

June 12 ~ Commencement

June 12-14 ~ Alumni Reunions

June 15 ~ Alumni Homecoming Day



~ and these are EXTRAS
[Fill in blanks, if any, and insert at appropriate spots]

~ Vernal ennui sets in

~ "Representatives of the XYZ Corp. will be on campus next Wed. to interview..."

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Class Review

Copy for this issue of *Technology Review* was due from your secretary August 12. News reaching him after that date will appear in the December issue of the *Review* unless he requested that it be inserted as late news to be found on the last page of the Class Review whenever such news is submitted. The "of note" column will resume in the December issue.

95

A recent telephone conversation with **Luther Conant** revealed he is confined to his room in the nursing home in Connecticut.

In June, I am glad to report I went to the White Cliffs for luncheon and saw several Phi Beta Epsilon men. Sam Spiker, '25, joined us at the table where he and my son became acquainted. Tyrrell Cheney, '03, "Warrie" Norton, '21, and I visited for a few hours.

Through John Nolan, Class Secretary for 1903, I learned that **Fred Richards** left $48,000 to M.I.T. to be used for scholarships, preferably for Somerville, Mass. boys.

Highest honor awarded
It was a great honor—and a real surprise—for me to receive a 1969 Bronze Beaver Award from the Alumni Association, for which I am truly grateful.—**Andrew D. Fuller,** Secretary, 1284 Beacon St., Brookline, Mass. 02146

96

It is with regret that we announce the deaths of two members of the Class, both of whom were in Course I, and both of whom were natives of the state of Maine.

Harold S. Boardman died on August 27, 1969 in a nursing home in Waterville, Maine. He had suffered a heart attack just a short time before his 95th birthday last March 31. After graduating from Maine State College (later the University of Maine) in 1895, he came to M.I.T. and received a B.S. in civil engineering. Mr. Boardman returned to teach at his Maine alma mater and except for a few years at the turn of the century when he worked with some Pennsylvania bridge companies, his entire professional life was connected with the University at Orono. "Boardy" progressed through the ranks from instructor to professor and was successively head of the department of civil engineering (1904), Dean of College of Technology (1910) and President of the University in 1925. He retired from this position due to ill health in

Andrew Fuller, Secretary of the Class of 1895 and one of this year's Bronze Beaver recipients (see text of citation below), chats animatedly with Warren Norton, '21 (right), at last June's Phi Beta Epsilon luncheon.

Bronze Beaver Award Citation to Andrew Fuller, '95

"As a student, alumnus, and alumni officer for over 75 years, and especially as Class Secretary, as a charter member of the Alumni Council 60 years ago, and now as a member of the Alumni Advisory Council, he is an inspiration for devoted and effective service to his fellow alumni. It is a privilege for the Alumni Association to pay special tribute and extend sincere thanks from all his fellow alumni officers."

1934, but led an active life for another 35 years. During the "great depression" he was able to continue the growth of the university, increase its faculty by 10 per cent and maintain faculty salaries without cuts.

Harold Boardman was married in 1897 to Caroline Hilton who died in 1910. His second wife was the former Nellie Mann, of Bangor, who died only two years ago. He is survived by one son, James, of Waterville with whom he had made his home.

George E. Harkness died at his home in Dorchester on September 2, 1969, after a brief illness. Born in Rockport, Maine on January 15, 1872, he entered M.I.T. with an earlier class, but was forced to leave after one year because of ill health. I remember hearing his tale of the over-land train trip to San Francisco in order to meet his sea captain father and his sailing vessel at that port. After a year or two at sea he was well enough to join the Class of '96 in Course I. Mr. Harkness worked for the Massachusetts D.P.W. and was chief bridge engineer at the time of his retirement in 1942. He was also a special examiner for the state civil service commission. It was in this that he and my father worked together and so he was one of the few class members your acting secretary knew. In 1903 he married Virginia Jewell who died a few years ago. After retirement they spent all the cold months at their home in Orlando, Fla. There are no immediate survivors.—**Clair Driscoll,** Acting Secretary, 11 Cliff St., Plymouth, Mass.

98

During the last week in May I had a nice visit with **Joe Riley** in his pleasant home, 518 Great Plain Ave., Needham, Mass. The cars whizzed by the front yard but the back yard dipped into picturesque woods with a brook. Joe does his own cooking, and sometimes he receives invitations from a niece and also a nephew who live in Needham. Two of his great-nephews were then graduating from college and another one was in Vietnam. We had a long conversation about classmates of '98 and about the present "demands" of some of the students.

Trailering with my retired husband has been fun. In July and August we enjoyed four beach areas: Newport, R.I., Rocky Neck and Hammonasset in Connecticut, and Cape Cod. (You know which state!) Between trips we drove home to read the mail and mow the lawn.—**Mrs. Audrey Jones Jones,** Acting Secretary, 232 Fountain St., Springfield, Mass. 01108

99

The Class of 1899 celebrated its 70th reunion at M.I.T. at the luncheon on June 16. Four members of the Class attended. President **Norman Seavey** and his wife, Minnette, came up from Florida. **Frederick W. Grover** had just returned from a 50-day trip to the Pacific, including among other places Australia, New Zealand, Tonga, and Bali. **Carroll W. Brown,** of Rye Beach, N.H., was accompanied by his son William H. Brown, '33. **Percy W. Witherell,** class representative, was accompanied by his son Richard H. Witherell, '49, and his wife, Nancy. All present enjoyed it immensely, and thanks are due Don Severance, '38, and his staff for arranging rooms. **Philip Burgess** did not come but sent his greetings to all.—**Percy W. Witherell,** Secretary, 1162 West St., Wrentham, Mass. 02093

01

The Alumni Association informs us that among the students entering this fall's freshman class at the Institute is John A. LaRoche, of Peterborough, N.H., grandson of our classmate **George A. Hall.** John's great-uncle was also an M.I.T. graduate—William T. Hall, '95, M.I.T. Professor of Chemistry, 1898 to 1940.

The *Herald,* Manchester, Conn., reported on the death of **Howard Irving Wood** last April 8. Mr. Wood, the paper noted, was a prime developer of many different types of lights for homes and industries. He was employed at the General Electric Co., Schenectady, N.Y., for many years before his retirement in 1932.

William Grove Blauvelt, Course VI, who had had to retire in 1932 because of ill health, died last January in Sudbury, Mass.

From Calvin H. Mohr, '33, we received the *Times Union,* Rochester, N.Y., report on the death May 5, of **Charles K. Flint.** He had retired in 1952 as general manager of Kodak Park in Rochester. Survivors include his wife, Elizabeth, two daughters, a son, six grandchildren and one great-grandson.

Mrs. **Pauline McDowell Atkins,** Course VIII, who did postgraduate studies with our Class died last year in Manasquan, N.J. Mrs. Atkins was the last survivor of the 1890 founding meeting of the Daughters of the American Revolution. From 1924 to 1941, she had been supervisor of science in the Elizabeth, N.J., Public Schools where she had previously served as a chemistry instructor.—**William G. Holford,** Secretary, 921 Patterson St., Klamath Falls, Ore. 97601

03

Well, classmates, it is apparent that the customary pleading of your Secretary to continue the chain of autobiographies of our treasured classmates has met with a most welcome response from **Charles B. Cox,** Course I, 503 Orondo St., Wenatchee, Wash.

"Hi Classmates! I hesitate to publicize my rather uneventful life after reading so many interesting and exciting accounts by other members of our Class, so no hard feelings if you drop out when part way through this recital. Try to remember, to me at least, life has been an interesting and self-satisfying experience and my four years at Boston Tech constitute one of my fondest memories. To you whose classes I shared, I was known as the 'Deacon,' probably on account of my austere countenance! Well, I haven't done much 'deaconing' since I left M.I.T. —too busy trying to irrigate the arid West.

"As I am 88 years of age on next November 4, and while my health is still good, yet my sight is now becoming quite dim, requiring a magnifying glass. So I thought it urgent to accomplish this story without delay. [Charles graduated from the Newton High School in preparation for entering M.I.T. and graduated in 1903 with out aspiring classmates.—Sec.]

"In April of my Senior Year I had passed an examination given by the newly formed 'Reclamation Service' (then a branch of the U.S. Geological Survey) so almost immediately after graduation I 'took off' for Spokane, Wash., to join a field party to survey the possibilities of irrigating a large tract of land in central Washington, now known as the Columbia Basin Project.

"Our job that summer was to survey a 3,000 acre-foot gravity canal down the Spokane and Columbia Rivers, from the City of Spokane to the current site of the Grand Coulee dam. The 'Big Boss' of our outfit had never before seen a plane table and as I had fortunately enjoyed a couple of hours practice at M.I.T. summer school, I was allowed to preside at the table, another benefit of Boston Tech's comprehensive training! But alas, for our hopes of a large feasible irrigation project, an 18-mile tunnel put the financial damper on our survey and we were transferred to other work.

"Before graduation I made no world-shattering record at M.I.T. However, I did manage to win the University Chess Championship in my freshman year. Then I was faced with the problem of giving up either college or chess, there simply wasn't time for both, so I played no more chess after my first year.
[After graduation Charley spent seven years with the Bureau of Reclamation. He passed the next 15 years in business as a private engineer and horticultural advisor and cultivator—a hobby of his since childhood]"—but engineering was in my blood, so went back again as bridge designer for the City of Portland, Oregon.

"The use of reinforced concrete was then (1925-1930) becoming prevalent and most of the city's bridges involved this material. (I think most of you will recall, that we graduated before the study of reinforced concrete was added to the curriculum of civil engineering.) Accordingly, I had to acquire a lot of outside study and become familiar with its rather intricate possibilities.

"Then came the Big Depression, seven years of hard times when engineers were a dime a dozen. But we 'raked our leaves' diligently and managed to pull through, then President Roosevelt decided to build Grand Coulee Dam so I spent 16 years of my engineering career on this mammoth project as a hydraulic engineer. It was a real privilege to be associated with this tremendous undertaking which provided many challenging problems.

"Not a very exciting life, comrades. Well, perhaps not, but to me it has been full of interest, hard work and fullfillment. In 1914 I married Miss Agnes Hickman of Spokane and for 55 years she has been by my side to offer encouragement, comfort and help when needed. We have two fine sons of whom we are proud—both are doing well. As for excitement during these 66 years I have been in imminent danger of death on seven different occasions: two from drowning, four from automobile accidents and once from a pack of seven hungry timber wolves.

"One strange item I reluctantly mention in closing, M.I.T. men are well scattered over the world, yet in the past 65 years, I have never met a classmate or any Boston Tech graduate other than at our 50th class reunion. Probably my own fault, but it seems strange that we alumni do not adopt a customary welcome among ourselves, especially when visiting distant terrain."

The latest obituary notice for our Class is that of **Harry R. Low,** Course III, who died at age 89 on Monday, July 7, at Cardinal Cushing Hospital in Brockton, Mass. Harry was born in Brockton, son of the late Emery M. and Ida (Colbath) Low. He prepared for M.I.T. at Brockton High School to join our classmates and graduate in 1903.

After hazardous mining labors in the rural country of Colorado and Wisconsin, he returned, in 1921, to his native Brockton and joined his brother, Herbert C. Low, in a quieter atmosphere, as manager of the E. M. Low Paper Box Manufacturing Company. Harry soon took active interest in local affairs. His keen interest in varied athletic activities during college was soon reactivated. He taught tennis to the younger members of the local Y.M.C.A. and became a prominent member of its bowling league. As for baseball, throughout his life he was an avid devotee. As a member of Phi Gamma Delta fraternity, his interest in M.I.T. alumni was ever active.

Harry Low was a participating member of St. Paul's Episcopal Church and was honored in 1950 for more than 25 years of service as vestryman and clerk of the parish. His survivors include three sons, Charles H. of Stoughton, Emery M., '29, of Baltimore, Md., and Lawrence G. of Braintree; a daughter Doris L. Low of Washington, D.C.; a brother Herbert C. Low of Brockton; three grandchildren and one great-grandchild.—**John J. A. Nolan,** Secretary and Treasurer, 13 Linden Ave., Somerville, Mass. 02143

04

I was unable to attend the Alumni Day exercises this year (my first miss in many years). A letter from **Maynard Holcombe** our Vice President in the South will give you the "happenings" as far as '04 was concerned: "Dear Gene—Martha and I got to the Administration Building early Monday but **Mary Hayward** and a friend, Miss King, formerly employed at M.I.T. and now retired, were the only other class of 1904 members and friends who showed up, and they only attended the luncheon and afternoon exercises at the cage, but we were very glad to see them. There were a number of other early classmates, like Fred Goldthwaite, '05, whom we knew and who made things interesting for us. Also the debaters (?) who displaced the final discussion of 'the human purpose' in Kresge auditorium, provided an entertaining and sometimes sparkling but not really illuminating afternoon interlude preceding the Apollo movie—a clever supplement to the prearranged program."

Dean Comstock reports that he, **Maynard Holcombe** and Maynard's wife Martha, had dinner together at Igo's Sunday night before the Alumni Day festivities and that both of them were in fine fettle after their trip to Hawaii for the Rotary International Convention there in May. "Participate" was the keynote of the Rotarian's convention, meaning that all men of good will must join in promoting what M.I.T calls "the human purpose." But the will to extend understanding of this purpose to all peoples needing help in today's world is lacking in today's educational system, according to its critics in Rotary. "Incidentally, I don't think I know anyone who looks as much younger than his real age than Maynard. I expressed this feeling to him during the course of the evening when he mentioned some meeting he attended and said, "The people here divided themselves naturally into the 'kids' and the 'elders'." I kept straight-faced but asked him, "Which group did you belong to?"

A post card received earlier from Maynard while he was in Honolulu notes changes taking place there. On his card he describes the new Royal Prince Hotel. "Ten tiers of motel rooms on a single narrow lot, typical of the new mode of living caused by automobile and airplane transportation but an architectural monstrosity in a resort area and spoiling Honolulu."—**Eugene H. Russell,** Secretary, 82 Stevens Rd., Needham, Mass.

05

From most angles, particularly attendance, our 64th reunion on Alumni Day was a big success. Present were Leonard and Bernice Cronkhite, Gilbert and Elizabeth Tower, Izzy Nye and daughter, Elizabeth Babcock, Art Balkam, Henry Buff, Gil Joslin, Herman Gammons, Doc Lewis, Harry Charlesworth and Ruth and I. Two tables were reserved for us, whereas classes graduating within a few years of us—up and down—combined to fill one. Mildred Stevenson had a reservation, but illness on that day prevented her attendance. Amidst all the jollity, little of news value developed. The **Leonard Cronkhite**s, back from a winter of recuperation and writing in Arizona were sunny and sun-burned. **Herman Gammons** still goes to his office in Boston at least four times a week. **Harry Charlesworth** still commutes frequently between New Jersey and New Hampshire, with occasional trips to visit his kin on Cape Cod and in Maine. **Henry Buff** still circulates freely from his quarters in Jamaica Plain. **Izzy Nye,** judging from postcards received from various resort hotels, still gets around plenty. **Doc Lewis** flitted from table to table at the luncheon, so that we had little time to hear of his latest journeys, honors, etc.

Hub Kenway intended to attend the reunion but couldn't quite make it. Ruth and I saw Hub and Helen at their farm in Franklin, N.H. recently. They are quite active and ambulatory.

This brings up the question of our 65th reunion next June. Our attendance during "off years" has been remarkable, but from the letters I receive I believe we could expect the home-coming of some of our classmates and wives who on account of the distance have not made it in recent years. I would like very much to hear from those in Florida, California and points in between, telling me of the kind of reunion they would appreciate. Room and board on campus are available. How about a campus week-end reunion with a class dinner on Saturday or Sunday night?

As you know, a beautiful service is held each year in the M.I.T. Chapel on the morning of Alumni Day, as a memorial to alumni and alumnae, who have died during the preceding year. On the roster are listed these '05 men and one co-ed: Fred Abbott, Percy Hill, George Perry, Mrs. Edward Pearson Ripley, Emil Steinberger and Wallace Taylor.

We haven't heard recently from **A. Senior Prince,** Course X, of Cincinnati. His last letter says: "I have not been a very good classmate which made my hearing from you all the more enjoyable. This time I send to you and my fellow classmates my warmest regards. Unfortunately, I have a broken hip right now and the doctors tell me I have five weeks more in the house. I must say though, I am getting along very well and think frequently of you and the rest of my fellow classmates."

Mrs. **A. Warren Wells** (Hazel), who is the family correspondent, writes: "Life moves on apace for us, though the extreme heat we have had since May does not encourage us to do much moving! I have found that the secretarial duties get lost in the shuffle of just keeping up with the necessary 'chores.' We are thankful to be able to do that. We had a pretty exciting June, considering! Warren celebrated his 88th birthday, and my daughter and her husband came for a brief visit to help me through my 80th! Sorry that alumni reunions, east or west, are no longer in our dreams. I do all the driving without difficulty, but today's traffic, especially into the northern areas, is just too much."

Herb Bailey says that there's little to tell about himself, but he is rightly proud of his family. He says about his son, Edgar, "He is perhaps the world's top geologist in the field of H_g minerals. Several years ago he was sent by U.S.G.S. to Turkey to establish a summer course in field geology under C.E.N.T.O. for the geologists of the Eastern Mediterranean countries and did such a good job he has had to go back there each year since. As I probably have told you, I gave up driving a car two years ago, so am now sort of 'house bound' as both my daughter Lucy and her husband have steady jobs, and all their three children have left home. Two of them are in Europe just now and the other one teaches a class of mentally retarded children out on the desert. I'm still in pretty good health but do not have enough pep to accomplish much these days. I do hope to get back into my pot shop now that it has gotten warm enough, as I have a lot of pieces half finished. My stamp collection provides me some diversion and of course TV and reading fill so many hours I could be doing something more worthwhile. There are so many 'doings', especially this time of year to which I am invited so I often see old friends and now and then make new ones. One of the most unusual was recently at the Herbert S. Bailey School where there are some 60 wayward boys of the County Probation Department. It's some 25 miles from my home but one of the teachers came for me and after a fine lunch, and the awarding of prizes for athletic events, brought me home again."

The Assistant to the M.I.T. Alumni Fund Director sends me this from **Leonard Conkhite,** some of which we had not learned previously: "Having just recently attended a reunion of the Class of 1905 at Brown University, and often being asked how does it come to be that I attend M.I.T. 1905 as well, I resort to the phrase, 'I commuted.' In any event, the M.I.T. group is especially inspiring. What other note is there about our personal lives? Answer—for four months each winter we gain repair in the hot sun of a place called Green Valley in southern Arizona, at the same time nourishing our minds by study. My wife, a former Dean (and thus my superior) works on the subject of Freedom and the Responsibilities of the so-called average voter citizen; whereas I modestly confine myself to such matters as world-wide situations. Some classmates have suffered copies of the articles. You may yet. Having now reached four-score years plus, we, like other 1905ers have entered into a second childhood, ready to join that special group which beginning in the crib, protests and demands power for power's sake, unneedful of experience past, present or future. 'Give us Power' or 'Kill Education.' Selah."

Yale reports of **Bob Luce:** "Captain Robert F. Luce was born in Melrose, Mass. After graduating from Melrose High School he attended Massachusetts Institute of Technology before joining our Class. He majored in civil engineering in preparation for his life work with the U.S. Coast and Geodetic Survey. Bob was a commissioned officer in this service from graduation until his retirement with the rank of captain. His work carried him to many parts of the world and he had command of numerous ships. In June 1917, on order of the President, he was transferred to the Navy where he attained the rank of Lieutenant Commander. During his tour of duty in the Navy he made 11 round trips transporting troops to France. On February 25, 1919, by executive order of the President, he was transferred back to the Coast and Geodetic Survey and resumed command of the U.S.S. *Isis.* In the years that followed he commanded various vessels and engaged in special oceanographic cruises along the Atlantic, Gulf and Pacific Coasts. For two years he was director of coast surveys in the Philippine Islands and then returned to this country to take command of a survey steamer hydrographer. In April 1936 he returned to the Washington office of the Survey. He made his home in that city on retirement. On November 30, 1915, he was married to Edith Laurence Hutson. They have a son, Robert James Luce." Your Secretary wrote the Captain recently with birthday greetings only to receive a brief note from Mrs. Luce conveying the sad news that he had passed away February 5. Mrs. Luce may be addressed at Apartment 820, 3130 Wisconsin Ave., N.W., Washington, D.C. 20016. This comes as a surprise to me. I had not heard of Bob's death. I have written Mrs. Luce a note of sympathy.

My notes in the July-August issue brought this comment from **Charlie Smart:** "Congratulations on being a Mason over fifty years, Fred, and Ruth, living with a Mason for fifty years. I was 'raised' a Mason, a *short* time before you, March 19, 1903, so I received my 50 year pin, (I just looked at it) in 1953. I was secretary of Republican Lodge, Greenfield, Mass., my home town, from 1909 to 1913 and master of the Lodge from November 1918 to November 1919. We had many extra meetings to 'raise' boys in the service and those going into the service. I went to a Grand Lodge meeting in Boston at the time of the police strike, which of course you remember. I saw many boarded up windows which had been broken, men in their street clothes acting as traffic officers on Washington, Tremont and Boylston streets and boys and men playing crap on Boston Common. I got back to the country that night. Why not ask the 1905 'boys' to tell of their experiences in Masonry." That last is a good idea. Even in our small group (39 now) there must be Masons who would enjoy hearing of their classmates' Masonic experiences. I went up the shorter way, Chapter, Commandery, Shrine (Aleppo of Boston, where I still have membership).

One change in address: **Chester R. Shaw,** 262 Adams St., Apt. 2, North Abington, Mass. 02351. Take your choice. He writes: "This is our fifth summer here but we are legal residents of St. Petersburg, Fla., as we have been for many years."—**Fred W. Goldthwait,** Secretary, Box 32, Center Sandwich, N.H. 03227; **William G. Ball,** Assistant Secretary, Box 8544, Bayshore Gardens, Bradenton, Fla. 33505

06

Our Class has lost its beloved President and long-time Class Agent. **Edward Sherman Chase,** Course XI, died suddenly July 8 at Newton-Wellesley Hospital following a serious operation. Our Vice President **Stewart C. Coey,** Course VI, was promptly notified at his summer

home on Squirrel Island and accepted the promotion to Class President, adding: "I will be glad to do anything in my power to help our old classmates get together now and then."

He was shocked by Sherman's death, of course, and aren't we all. Marion and I attended the service at his church, the Auburndale Congregational. There seemed to be an unusually large number of men present, many with their wives, an indication of Sherman's popularity and professional standing. I sent a gift, for the Class, in his memory, to his church. In his note of thanks the minister had this to say about Sherman: "His keen mind, his perpetual wisdom, and his deep concern for truth has added much to the measure of this household of faith—in these days of turmoil it is difficult to find a scientific mind which knew that beyond human thought there was a destiny that was eternal." As Class Treasurer, I sent a contribution in his memory to the 1906 Memorial Fund, which, you may recall, is a perpetuating fund set up by the Class last year.

Sherman Chase was born July 14, 1884, in Merrimac, Mass.; attended schools there and joined our Class in 1903, staying on with 1907. He spent a year as assistant to Professor Kinnecutt at Worcester Polytech and a year as chemist and acting resident engineer at Reading, Pa., for Hering & Fuller. From 1909 to 1913 he was in charge of the Reading sewage treatment plant, and was a consultant on sewage disposal, Borough of Richmond, N.Y., becoming, until 1920, the Assistant Sanitary Engineer for the New York State Department of Health in Albany. Since 1920 he had been with the Boston firm of consulting engineers, Metcalf & Eddy, becoming a partner in 1927. Sherman had been a Fellow of the A.S.C.E.; past president of the New England Water Works Association and of the Water Pollution Control Association. He was an Honorary Member of the Boston Society of Civil Engineers and the American and British Water Works Association, also of the New England, New York, New Jersey, and Pennsylvania Sewage Works Associations.

He was a Fellow of the American Public Health Association and a long-time member of the M.I.T. Alumni Council. As previously reported in class notes, Sherman was awarded its (first) Friendship Medal by the British Institute of Water Engineers for "his activities in fostering closer relations between British and American engineers."

His concern and interest in "what's going on" were illustrated by the note he sent to M.I.T. President Howard Johnson last April: "The recent demonstrations by militant radicals at M.I.T. is highly distressing to concerned alumni. . . . I do wish to express my hope that the administration at the Institute will not adopt the spineless attitude shown by administrations at certain other universities." Through the years Sherman was a contributor to the engineering and technical press and was the inventor of a trapless siphon for sewage dosing tanks.
In 1911 he married Frederica Atherton, who died in 1922 and in 1924 he married Bertha A. Chesley who survives, a son also survives.

Less than a month before his death, Sherman had sent me a note enclosing the obituary of **Allyn Chandler Taylor,** Course II, who died June 1 in a Reading, Pa., hospital. He had received the report of Allyn's death and the clipping from a daughter, Mrs. Robert H. Cook, to whom I promptly sent a letter of sympathy for the family. His wife Florence, who had accompanied Allyn to some of our reunions, died in 1966. Allyn was born June 16, 1884, in Lawrence, Mass., attended schools there and graduated with us in 1906. His thesis was *Experiments in the Flow of Steam Through Orifices under Small Differences of Pressure.*

His professional career was entirely with gas companies in South Carolina and in Pennsylvania. He held various offices with the Consumers Gas Co. of Reading, becoming president in 1931 and Vice President of U.G.I. in 1953. He had been President and Director of Pennsylvania Gas Association, Director of the American Gas Association and Director Emeritus of the Bank of Pennsylvania. A resident of Wyomissing Hills for many years, he had been president of the Borough Council for 16 years; president of the Rotary Club, the Country Club, and the United Fund of Reading; director of the Auto Club; trustee of Reading Y.M.C.A.; director of Pennsylvania Chamber of Commerce and active in church work. Did Allyn Taylor lead a useful, rewarding, life would you say?

Marion and I went to M.I.T. on June 16 for the Alumni Day luncheon and speeches. The two regulars were there—**Bill Abbott** and **Walter Davol,** who later sent us a postcard from Portland, Ore., where he was visiting a son.—**E. B. Rowe,** Secretary-Treasurer and Acting Class Agent, 11 Cushing Rd., Wellesley Hills, Mass. 02181

08

The classmates attending Alumni Day June 16, 1969 were: Wilfred E. Booth, Leo Loeb and Mrs., Howard B. Luther, Franklin T. Towle, and Joseph W. Wattles, 3rd. It was unfortunate that more of the Class could not attend the 61st reunion June 14-15 at the Melrose Inn in Harwichport. Those attending were: Harry C. Lord, Henry R. Sewell and Mrs., Wilfred E. Booth, and Joseph W. Wattles, 3rd.

We are sorry to report the death of several members of our Class; **Stanley Purdy** January, 1968; **William B. Given** January 30, 1968; **Harold B. Pickering** March 5, 1968: **Joseph G. Reid** June 1, 1968; **Carl E. Hollender** October 25, 1968; and **Harry H. Bentley** November 9, 1968.

As you remember, **Gregory M. Dexter** of 32 Fenmore Rd., Scarsdale, N.Y., reported in the July/August *Review.* A letter has been received from Mrs. Dexter enclosing his obituary from the *New York Times.* Gregory M. Dexter died June 20, 1969. He was a direct descendant of Gregory Dexter the third Governor of Providence Plantation in colonial times. Mr. Dexter was with the Honolulu Iron Works Co., and Bitting Inc. both of New York before becoming a consulting engineer. Surviving are his widow, a son, two daughters, a sister and five grandchildren.

Joseph Pope, 82, of 16 Hamilton Ave., Bronxville, N.Y., died January 20, 1969 according to an obituary from *New York Times.* He was an engineer who specialized in shipbuilding and power facilities. After graduating from M.I.T. in 1908 Mr. Pope worked with the American International Shipbuilding Corporation, the Fall River Shipbuilding Co., and the Baton Rouge Electric Co., before joining Stone & Webster in 1912. Mr. Pope retired in 1955 as first vice president of Stone & Webster Engineering Corp. of New York City. He became a consultant and was retained by the Transit Authority of New York City in 1957 to study power production. Mr. Pope was a founder of the Gulf States Utilities Co., the Tampa Electric Co., and the El Paso Electric Co. He is survived by his widow, a daughter, a son, and 17 grandchildren.

C. Ernest Whitten, 83, of 40 Hawthorn St. Lynn, Mass., the last surviving partner of the C. E. Whitten & Sons auto dealership of Lynn, Salem, and Beverly, died January 14, 1969 according to the obituary in the *Salem News.* He died in a local nursing home after a long illness. Mr. Whitten was born in Lynn, graduated from Lynn Classical High School and M.I.T. His father the late Chas. E. Whitten founded the family auto firm in 1885. His son expanded the business which was sold in 1965. During World War I, Ernest was an army artillery Captain, and in World War II served on bomb demolition teams for the office of Civil Defence. Mr. Whitten was a member of the Golden Fleece Lodge of Masons and Massachusetts Consistory of Scottish Rite Bodies, Salem Country, Rotary and Oxford Clubs. He is survived by two sisters, Mrs. Jessie F. Gifford of Lynn with whom he resided and Mrs. Smith of Swampscott.

Carrol D. Steele, 82, of 330 East 3rd St., Duluth, Minn., died February 3, 1969 in Duluth Hospital. He was owner of the former printing and engraving firm of Steele-Louneberry Co. Born in Jamestown, North Dakota and a resident of Duluth since boyhood, he was a veteran of World War I and a 50-year member of the American Legion Post. A member of the Rotary and Athletic Clubs as well as the Pilgrim Congregational Church, he is survived by his widow, a daughter, a sister, a stepdaughter, a stepson, and 18 grandchildren.

We also regret to report the death of **Henry V. Spurr,** 83, on May 3, 1969. He passed away at the Martha's Vineyard

Hospital after a long period of failing health. According to the *Edgartown Gazette* June 9, 1969, his family were the first summer visitors to Edgartown on the Vineyard. Born in Arlington, Mass., and graduated from M.I.T. he first worked as a draftsman on heavy bridge projects for the Pennsylvania Steel Co. (now a part of Bethlehem Steel). After 16 months experience he became Assistant Bridge Engineer of the Boston & Maine R.R. in Boston. In 1910 he went to Chicago as bridge designer for the Chicago & Northwestern Railroad. In 1911 Mr. Spurr applied for a position at the Chicago office of Purdy & Henderson who did considerable work in designing tall buildings. With the exception of the years 1917-1918 when he was an officer in the Army Engineers, Mr. Spurr worked for Purdy & Henderson until 1942. From 1912 to 1917 he managed their Montreal office. In 1919 he moved to New York and became their Chief Engineer and in 1934 was made Vice President.

His first years as draftsman on heavy bridge projects aroused his interest in wind bracing which later prompted his book, *Wind Bracing of Skyscrapers,* published by McGraw Hill; it is a classic of engineering progress. Mr. Spurr himself took charge of several tall buildings in New York including the Bank of Manhattan 71 stories and 900 ft. high. This building was considered the tallest in the world for some time.

He is survived by two daughters, Mrs. Marlatt of Edgartown, and Mrs. Marie Mueller of Greendale, N.Y., and by three grandchildren.

Changes of address: Louis S. Gorden, 75 South Shore Dr., Apt. 4A, Normandy Island, Miami Beach, Fla. 33141; Karl R. Kennison, 29 Central St., Auburndale, Mass.; Leo Loeb, 870 United Nations Plaza, New York, N.Y. 10017; Mrs. John H. Williams, 6300 Greene St., Philadelphia, Pa. 19144—**Joseph W. Wattles, 3rd,** Acting Secretary, 26 Bullard Rd., Weston, Mass. 02193

09

In accordance with the schedule given in the notices of the 60th reunion, 20 gathered on Sunday afternoon, June 15, at McCormick Hall on the M.I.T. campus: George Bowers, Margaret (Mrs. John F.) Davis, Chet and Muriel Dawes, Tom Desmond, Mayo Hersey, Ed Howe, Ben and Barbara Pepper, Art and Betty Shaw, Laurence Shaw, Henry and Madge Spencer, Harold Stewart, Lockwood and Mrs. Towne with their daughter Polly (Mrs. M. H. Hunt), and Melville Weill and his granddaughter. As at recent reunions, Alice Desmond was obliged to remain in a Boston hotel. We were greatly disappointed that our assistant secretary, **George Wallis,** and Marcia, who have always taken such an active part in class reunions, felt unable to come. **Brad Dewey** sent an affirmative reply on his card stating that he would attempt to make it with the qualification, "unless my bum leg behaves better than it has recently, I am afraid I will end up by missing it." As it turned out Brad couldn't make it. He adds, "Marguerite and I have a little apartment at 100 Memorial Drive."

We recall from recent class notes that **Leon Healy** and Ruth were both anticipating and planning to come. However, Leon appended a note to his reply: "I expect to be at the Class Reunion but Ruth will not be able to come. She will be attending the graduation of our granddaughter, Heidi, from high school. Heidi is class valedictorian." We missed Ruth who has always attended our reunions so faithfully.

As will be recalled, Art Morrill, from Caracas, Venezuela, came the greatest distance to the 55th reunion; **Leon Healy,** from Milwaukee, has the honor for the 60th. **Phil Chase,** who has also consistently attended our reunions, stated that he felt obliged to attend the 300th anniversary of the founding of Dartmouth College of which he is also an alumnus. **Julius Sirra,** who has attended Alumni Days and reunions regularly, wrote from Staten Island: "I had planned to attend the 60th reunion but now think it unwise for me to do so." He stated that he has what they call asthma. "Whatever it is causes a condition which is unpleasant at times so that I don't care to leave my room for more than an hour or two. Sorry not to get there but hope you have a good turnout and know you will hear interesting things as well as enjoy meeting classmates and other alumni."

Weston Radford wrote from Fort Lauderdale, Fla.: "I am sorry that Mrs. Radford and I will not be able to attend the 60th reunion this June. We had hoped that we could make it, but it is not to be. So I have reluctantly returned the postcard marked 'No.' I am sure that you will have a most successful reunion and that many will be back for it. Please give my best to all old acquaintances." **Thomas Atherton** returned his card marked "No, sorry, too old." and stated that he had moved from Pennsylvania to Milton Head Island, S.C., in 1945, had obtained a South Carolina license and is doing architectural work for the Beaufort Historical Commission. **Robert Blankenbuehler** wrote: "I cannot attend the reunion as there is a very serious illness in the family (not me). As I am today I feel like making my reservation for 1979!"

Bion Bowman's card from Pompano Beach, Fla., stated: "Sorry unable to attend due to being away from Boston." **Edward Chapman:** "Wish I could attend. Eyes are bad, memory also very bad." **Kenneth Campbell** from Sioux Falls, S.D.: "Sure would enjoy being there; greetings and best wishes to all." "Steve" **(J. N. Stephenson)** from Wolfeboro, N.H.: "Best wishes for a good time."

Elmo A. Robinson, Professor of Philosophy, Emeritus, San Jose State College, Los Alamos, N.M., earlier made a trip East which he thought might be extended long enough to attend the reunion but the necessity of returning home sooner than expected prevented it. **George Hodsdon, Sr.,** stated that Mrs. Hodsdon had passed away so he sold his home in Gloucester and moved to Fort Myers, Fla. There were other replies with regrets from several classmates stating that distance or disabilities prevented their attending.

As an aftermath of the reunion, **Lockwood Towne** mailed a check for the Alumni Fund stating, "I thoroughly enjoyed the Homecoming luncheon and realized what I have missed in being unable to be a regular attendee at the annual meetings of the Class due to the roving nature of my job with Stone & Webster, Inc. I shall do my best to do better in the days and years left to me."

There were approximately 135 notices (each mailing) sent out and, not including duplicates, there were 66 replies of which 12 were Yes and 54 No. We were most fortunate to have the glass-enclosed penthouse on the roof of McCormick Hall assigned to us for our meeting room. The weather was clear and the view of the surrounding territory, including Boston Harbor in the distance, was excellent. With the well-upholstered chairs together with light refreshments and a large bowl of punch, we enjoyed the afternoon chatting and reminiscing about our recent and past experiences. The accommodations and decor of the entire dormitory with beautifully furnished, homelike lounges, added much to our pleasure.

At 6:30 we convened to the Stratton Student Center for the Homecoming buffet supper and entertainment which consisted of many old-time movies with their accompanying songs such as "Home on the Range", etc. At 11:15 on Monday morning there was a Memorial Service in the M.I.T. Chapel for alumni deceased during the past year which included Merton Belcher, Clarence J. Brown, John F. Davis, Carl W. Dwight, V. Carl Grubnau, Lester H. King, and Henry C. Turner of our Class. At noon we all attended the Homecoming luncheon in Rockwell Cage at which James R. Killian, '26, Chairman of the Corporation, the Honorable Francis W. Sargent, '39, Governor of Massachusetts, and the Honorable Luis A. Ferré, '24, Governor of Puerto Rico, were the speakers. We adjourned about 2:30. Although our members are becoming fewer, it was most enjoyable to meet and talk with those who are still active and able to travel to our reunions and who are also instrumental in carrying on the traditions of our Class.

Shortly after the adjournment of the Homecoming program your Secretary and Muriel took off on a trip to Europe. We first enjoyed a North Cape Cruise on the ship *Meteor,* sailing through deep fjords and making several land excursions through Norway's mountainous country. On two evenings we were able to see and photograph the midnight sun

well above the horizon. Later we visited Denmark making a three-day "Fairytale Tour" through Hans Christian Andersen territory, and then visited Venice, Rome, Florence, and Dubrovnik before returning at the end of July. While in Rome we made a tour of the Etruscan Fields in which ancient tombs were built within large circular mounds or deep underground. Frescoes on the tombs' walls are still well preserved after many centuries. Several of these tombs dated back as far as four or five centuries B.C.

On the return of the Secretary to his office in mid-summer, he received a notice of the death of **Van Bush**'s wife, Phoebe. As may be recalled, Van is an honorary member of the Class. The secretary sent a note expressing the sympathy of the Class as well as his own to Van, his sons and their families.—**Chester L. Dawes,** Secretary, Pierce Hall, Harvard University, Cambridge, Mass. 02138; Assistant Secretary: **George Wallis,** 185 Main St., Wenham, Mass. 01984

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Attendance at Alumni Day this June was the smallest we have ever had. The only regulars present were Bob Burnett and wife, Murray Mellish and wife, Charles Wallour and wife, and George Lunt. I had planned to attend but I contracted a bad cold the week before while at the Cape and thought it would be best not to expose anyone else to it.

I received the following clipping from the *Wellesley Townsman* regarding the death of **Curtis M. Hilliard:** "Curtis Morrison Hilliard, 81, died at Newton-Wellesley Hospital on May 14 after a long illness. A native of Dorchester and resident of this town since 1919, Mr. Hilliard was elected to the Board of Health in 1921 and served until retirement in 1956. He became supervisor of the combined Wellesley, Needham and Weston health boards. Mr. Hilliard studied Public Health Science at Massachusetts Institute of Technology after graduation from Dartmouth College, Class of 1909. Following four years of teaching in New York and Indiana, he became associate professor and head of the department of biology and health at Simmons College, Boston. He was full professor from 1918 until 1952, when he was named professor emeritus. During World War I Curtis Hilliard served as sanitary officer at Camp Taylor, Louisville, Ky., with rank of First Lieutenant, U.S. Army.

"In World War II he was director of the health division of the Massachusetts Committee on Public Safety. Town Flags were lowered in his honor."

I received the following card from **Alva B. Court:** "After living in California since 1941 and being self-employed most of that time, my wife and I tore ourselves loose from San Francisco to come back East where we are much nearer our son's family—his wife, their seven children, and our first great-grandson."

H. Gordon Hawes, Jr., writes as follows: "Being 85 years old and no longer very active I think it is about time I applied for a seat among the old timers who spend their time sitting in the sun and watching the girls go by."

Charles A. Robb writes as follows: "Retired as Chairman, Department of Mechanical Engineering, 1956—Consulting Engineer."

Mrs. **Joseph Maxfield** writes that her husband is now blind and requests that the *Technology Review* be discontinued and his small contribution be used elsewhere. —**Herbert S. Cleverdon,** Secretary, 112 Shawmut Avenue, Boston, Mass. 02118

11

I'll start the new year's notes with a correction. In the notes for last May, I reported the death of **William C. Davis, Jr.,** on December 1. The rest of that note did not apply to him.

A letter from Mrs. Davis enclosed a copy of the following clipping from the *Virginia Pilot.* "William Couch Davis, Jr., formerly right of way agent for the Seaboard Air Line Railroad, with headquarters in Norfolk, has retired after 30 years of service with the road. A native of West Point (Va.) Davis received his education at Washington & Lee University and Massachusetts Institute of Technology. His first railroad work was in Cuba where he was a draftsman and instrumentman for the Cuba Railroad in 1909 and 1910 and again in 1913 following more than a year's service with the Brazil Railway in the location and construction of railroad lines in Brazil. Returning to this country, he was with the Central of Georgia Railway and the Interstate Commerce Commission prior to serving as a volunteer ambulance driver with the American Ambulance Service in France after the outbreak of World War I. After the entry of the United States into the war, he joined the United States Army and held the rank of Second Lieutenant in the Engineer Corps. During four of the next seven years, he was connected with the state highway department of Tennessee, being located in Cuba for three years. He joined the Seaboard's real estate department in January, 1925, and was active in that phase of the railroad's operations until his retirement last Tuesday." This clipping was dated August 4, 1956.

Only three members of our Class attended the Alumni Day lunch June 15, two besides myself. Gertrude and **O. W. Stewart** had with them **Carl Richmond**'s widow, Helen, who had just returned from a very enjoyable trip to Greece and Italy. The Stewarts' son, David, also sat with us. **Morris Omansky** told that his grandson, M.I.T. '70, is working this summer for Procter & Gamble in Cincinnati. On the morning of Alumni Day, memorial services were held in the chapel for Tech men whose deaths had been reported during the past year. The following classmates were included: James K. Campbell, Stuart B. Copeland, William C. Davis, Jr., Norman S. DeForest, Joseph Gershberg, Lloyd A. Patrick, Armand H. Peycke, Wellesley J. Seligman, Edwin C. Vose, and Alexander W. Yereance.

I have some other deaths to report: **Charles W. Homeyer** of Robstown, Texas, died November 8 of last year. . . . **Maurice J. Lowenberg** of Brookline, Mass., died March 13. He was born in Roxbury in 1888, prepared for Tech at Boston English High School and graduated in electrical engineering. . . . **Samuel H. Cornell** of Garden City, N.Y., died April 19. He was born in 1890, prepared for Tech at Hamilton Institute, New York, and graduated in naval architecture. . . . **Minot Dennett**'s wife, Vera, died May 4.

A letter from his son contained the following about Samuel Cornell: "My father died in Hempstead General Hospital April 19, 1969 of a stroke and heart attack. He graduated from M.I.T. with a degree in naval architecture. He worked as a naval architect for a period of time after graduation, and then went to sea. He became chief engineer of a ship, came ashore as assistant chief and later chief engineer of the American Chicle Company, Long Island City, New York. In 1954 he retired, although he continued to do some consulting work for approximately one year."

Two changes of address have come in during the summer: Colonel C. Philips Kerr, Ellinor Village, Ormand Beach, Fla., and Theodore J. LaFreniere, 418 Pine West, Montreal, Province of Quebec, Canada.

In late August we received word from the family of **Calvin P. Eldred** telling us that he was *very* ill. Let's hope that by now he has made a speedy and complete recovery. We are awaiting further word.

The following is a portion of a letter from **Curtis Kinney:** "My wife, Irene and I spent a summer at North Truro where we attended the Farnsworth School of Art, having been at his school in Sarasota, Fla., two winters. Our summer on Cape Cod was a pleasant one. Your Rotary Conclave in New Hampshire will be a great experience I'm sure. I'm a founder, charter member and past president of our Rotary Club and for three years was editor of our Rotary bulletins which have been bound and are in our public library. After Course IV at M.I.T., I worked on the Woolworth building in New York and the Wisconsin State Capitol building in Madison, both great experiences. I finished the latter job in 1917 and joined the Royal Flying Corps which later became the famed Royal Air Force. After a brush with the Red Baron in France and being shot down on August 16, 1918, with a German bullet in my leg I returned to France on November 9, 1918, too late to get shot up again. In March, 1919 I returned to my home town in Ohio and was drawn into the family department store run by my first cousin. That was the most unexpected thing that ever happened to me, and I have been there ever since. This year the store is 100 years old and I

have been with it 50 years. I found the creative spirit can work in retailing as well as in architecture. Irene and I have had some wonderful experiences, a four months freighter trip around the world, a winter in Spain where we attended art school, two winters in Mexico, four in Florida and the last six winters in Scottsdale, Ariz. Our son, Mark Kinney, 42, Yale '50, is president of our company, mayor of Mt. Vernon and director of our largest and oldest bank. He has two sons and a daughter. Our daughter, Betsey, Smith and Mills Colleges, is married and lives in London, England with her husband and three daughters. I go to the store five days a week but we have such fine people that we have delegated much responsibility, this has been good, for in spite of greater competition business is fine."—**Oberlin S. Clark,** Secretary, 50 Leonard Rd., North Weymouth, Mass. 02191

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Do you remember our tenth reunion at Mayflower Inn in Plymouth, Mass.? The entertainment committee conceived the idea of a penny race similar to the old freshman stunt on the sidewalk in front of the Brunswick Hotel. We can still picture Weenie Schell on his knees in a tuxedo, pushing a penny across the dining room floor with his nose. Though not the winner, he was a good sport to accept the challenge.

On Alumni Day, June 16, Helen and I attended the luncheon and exercises at Rockwell Cage and Kresge, and enjoyed visiting with the seven other classmates who were present. These included Fred Busby, Bill Collins, Al Davis, John Freeman, Jerry Hunsaker, Bob Wiseman, and Cy Springall with his wife, Marjorie. The July issue of the *Review* has a complete write-up of the events, including the excellent record of the Alumni Fund, the addresses of President Johnson, Governor Francis W. Sargent, '39, of Massachusetts, Governor Luis A. Ferré, '24, of the Commonwealth of Puerto Rico, as well as J. F. Collins, former Mayor of Boston.

When leaving Rockwell there was a kind of "confrontation" by a group of S.A.C.C. students and sympathizers who were allowed to discuss their grievances with the Alumni before the scheduled presentation of the Apollo movies.

John (Buchie) **Freeman** and Mrs. Freeman drove up from West Palm Beach, Fla., where they have been living since his retirement from the American Tel. & Tel. Co., New York in 1952. Although neither have been in the best of health, they were able to make the trip north by auto and visited Jim Cook in Marblehead before returning. Buchie has just celebrated his 82nd birthday.

Jim Cook took his annual summer trip to visit **Harold Brackett** and his niece, Eleanor Forbes, at Limerick, Maine. Later they all spent a week with **Larry Cummings** and Julie at their Squam Lake cottage in Holderness, N.H. I did not get a report on their fishing catch, but understand that the fish are usually plentiful.

We regret to report the passing of **Pierre Drewsen,** Course X., which occurred in Northampton, Mass., on May 22. Pete came to this country from Norway with his family at the age of five, and grew up in Brooklyn, N.Y. He graduated from Amherst in 1910 and then entered M.I.T. On graduation he entered the paper manufacturing business. In World War I he served as an Army Captain and was later commissioned as a Major at Camp Lee. Following the war he returned to paper making and served as Chemical Director at Hinde & Dauch Paper Co., Sandusky, Ohio until 1944, when he founded the Amherst Craftsmen, a paper converting business in Northampton. Pete was most interested in the development of new processes and was granted 17 U.S. patents, as well as several in Canada and Great Britain, on this subject. In 1951, he was elected mayor of Northampton and instituted several worthwhile civic improvements while in office.

He married Dorothy Clausen of Buffalo in 1944 and had one daughter, a stepson and four grandchildren. Pete had not been well for some time and had undergone a serious throat operation. He told us last year that he planned to retire to Florida or Mexico. Our sympathy was extended to Mrs. Drewsen in behalf of the Class.

Word has reached us of the death of **Clyde Smith,** Course XI, on April 24 in Lakeland, Fla. He was in his 84th year and had recently moved from Gilbertville, Mass. He spent many years of his career with the State of California, principally on mosquito control.

Frank Caldwell writes from West Hartford, Conn., "It is nice to hear from someone in the Class of 1912 who is trying to do something for all of us. It is a long time since we were all together in the old buildings on Boylston Street. So many things have happened since then that it is hard to know where to start. During my years at Tech a number of us formed a small Aero Club and built several gliders which we tested on the site of the present campus. This experience whetted my interest in aeronautics so that nearly all of my working career was spent in this rapidly developing field. After a year or two with the Curtis Aeroplane Co., I went to work for the Aviation Section of the U.S. Signal Corps and became chief of the Propeller Branch. I had the privilege of developing the type of metal propeller that is still in use throughout the world. It is unusual for anything in the aeronautical field to endure for as long as fifty years. During this period I was also engaged in the preliminary development of the controllable pitch propeller.

In 1928 I joined the Hamilton Standard Division of the United Aircraft Corp., in East Hartford, Conn. Here I had the opportunity to complete the development of the controlled pitch propeller and to take part in its improvement by licensees throughout the world. In 1940, I joined United Aircraft as Director of Research and had a part in the development of their Research Laboratories. Here I continued until my retirement in 1955. While I enjoyed my career in the aeronautical field very much, I think I have liked my retirement years even more. I have endeavored to maintain a new field of interest as different as possible from that of my working years. My present hobbies are reading and golf which keep both mind and body active. Needless to say I have enjoyed very good health throughout the years."

To supplement the history of **Harold Mitchell** which appeared in the May issue of the *Review,* he has given us the story of his trip to Alaska in the spring and summer of 1968. This, he feels, will be the last of many long tours he and Mildred have taken through this country, Mexico and the Caribbean since his retirement in 1959. They left home in April, 1969, and first visited the cactus belt from Texas to California, then up the Pacific Coast, and taking part in several ornithological exhibitions. After visiting their daughter in Seattle they sailed the inside passage from Vancouver to Skagway, Alaska where they embarked on the 110-mile trip by narrow gage railroad to Whitehorse. They then travelled by bus over the Alcan Highway to Fairbanks where they attended the annual American Ornithologists' meeting.

Harold had a real holiday along the way on this two day trip as he saw many golden eagles, Dahl sheep and a moose. While there they took a number of field trips and saw many nesting birds which are winter visitors in our northern states. They then went southeast to the high tundra country of the Alaska Range, sighting various nesting birds of this region. Then down to Anchorage, stopping off for two days at the McKinley National Park, the high point of the trip. They left at 4 a.m. one morning for a long ride to Wonder Lake, 25 miles north of 20,000 ft. Mt. McKinley. Except for a five minute period, the mountain was hidden by clouds all day, but, they did obtain a brief view of the summit only, an awesome sight. They saw many arctic animals and the number of arctic birds made it an ornithologist's paradise. They stopped often en route to photograph birds and flowers. From Anchorage they took a bus trip to the huge Portage Glacier and The Alyeska chair lift. After flying back to Seattle and spending a week with their family, including a trip to Mt. Ranier, they went to Spokane and drove to the summit of Mt. Evans, 14,280 ft., the highest automobile road in North America. After visits to several parks and museums they flew home to Buffalo and were glad to be able to rest after a strenuous tour of about four months.

After several attempts we were successful in getting a brief note from **Lawrence** (Shorty) **Walker** who has lived in a

cooperative apartment in Bridgeport, Conn., since 1921. His first job was with the Lake Torpedo Boat Co., then with the Bridgeport Brass Co. and finally with the Bassick Co., in Bridgeport. He was married to Laura MacCutcheon in 1921 and has a son, William, who works for Xerox in Rochester, N.Y. There are three grandchildren, two girls and a boy. Shorty retired in 1955 and has been taking it easy since then. He used to enjoy sailing but has done little of late. He is treasurer ot the Retired Employees Club of the Y.M.C.A. His general health is excellent. We are glad to hear from you, Shorty. Hope to see you at our next reunion.

A brief note from **Cornelius Duyser** of New Hartford, Ct., indicates that despite his 82 years he is still able to keep a good vegetable garden and to indulge in his favorite sport of cussing out the administrations and the courts. Best wishes to you, Cornelius.

With this issue Jay and I are beginning our third year as purveyors of class news which, with your assistance, we hope to be able to continue in reasonable quantity. There are still 71 on the roster from whom we have heard nothing during this period, although we have written unanswered letters to nearly everyone listed. To the 74 who have contributed their biographies we again express our appreciation and that of other classmates who have so written us. To the ones who have not, we again ask that they send in at least a note to tell us what they are doing. We also suggest to those who have contributed that they make the effort to write again, perhaps sending in some recent news of themselves, their families, classmates or other comments. Only by this means can we keep the column alive. Please also advise promptly if you will be able to attend a 1970 reunion. So far we have only heard from six that they are interested.—**Ray E. Wilson,** Secretary, 304 Park Ave., Swarthmore, Pa. 19081; **Jay H. Pratt,** Assistant Secretary, 927 Fair Oaks Ave., Oak Park, Ill. 60302

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Welcome to the *Review* year 1969-1970. The last event of 1968-1969 was Homecoming Day (or Alumni Day) June 16 at the Institute. It was excellent as usual with several interesting programs and panels highlighted with speeches by James R. Killian, Class of 1926; our President Howard W. Johnson; the Honorable Francis W. Sargent, Class of '38, our Governor of Massachusetts; and the Honorable Luis A. Ferré, Class of 1924, Governor of Puerto Rico. Nineteen-thirteen was fairly well represented by Charlotte Sage, Phil Terry, Warren Glancy, Charles Thompson, Al Brown, Burt Cushing, Walter Muther and daughter Sally Lawton, Bill and Ellen Brewster, also Roz and Phil Capen, as "homecomers."

Many letters were sent out inviting all members of our Class residing in New England, New York, and New Jersey. Several of our loyal classmates sent their regrets: **Ken Hamilton,** "Sorry cannot make it."; **Dave Stern,** "Della and I are recuperating after an auto accident which occurred May 5 on Paradise Island, Nassau, so that it is not possible to join the mini-reunion. Please give our fond regard to the others and to yourself."; **Charles Edison,** "Many thanks for the information concerning the 'mini' reunion of the Class of 1913 scheduled to be held on Monday, June 16. I would very much like to be able to say that I would be present, however, my health has not been up to par of late and I must, with regret, say that I will not be able to attend. With all good wishes for a 'bang-up' time."; **Joe Cohen,** "Keep well."; **John Hessionn,** "Am afraid I'll have to be on the West Coast the week of June 16, so count me out. Hope the luncheon is a complete success."; **Ellis Brewster,** "Don't think I can make the lunch. Expect to be there for the cocktails and dinner."; **Herbert Shaw,** "We are sorry that we will not see you and yours this year. Will you kindly give our regards to those who know us?" We are very much pleased in Herb's interest in our eye trouble. **Alex Morrison,** "Sorry, I'll not be there."; **Alexander Pastene,** "Thank you for your good reminding note and the accompanying material. I am sorry to have to say I shall not be able to join the Monday luncheon on 'Homecoming.' There may be but a few '13ers present but whoever they may be, my hearty good wishes and 'hello.' " The "ill health" of the Secretary refers to flu and the cataracts, Al, in our letter of May 30.

Prime Fool Belmont Stakes challenger

From **George Wallace** we quote: "Many thanks for your letter of May 30 letting me know about the get-together for the Class of '13. I wish I could be with you boys on that date but I've a bunch of race horses so that now I am following slow horses and fast women for my retirement interests. If there is any possible chance of my getting around to see the boys I certainty will do so. In any event, you and they have my best wishes." Quote from the *Fitchburg Sentinel*: "Prime Fool, owned by the Holiday Stable of George R. Wallace of Fitchburg, Mass. is expected to challenge the big three of Majestic Prince, Arts and Letters, and Dike in the Belmont Stakes on Saturday."

Congratulations to you George, for that's what happened as Prime Fool did not win but did challenge the big three. Again, our boy George has been honored for his philanthropic work in education as well as community contributions to his home city of Fitchburg, Mass., and again we quote in part: "George R. Wallace, Jr., 98 Prospect St. former head of the Fitchburg Paper Co. now Litton Industries and widely known for his philanthropic work, will be honored Sunday afternoon at 3 by the Fitchburg State College when he will be presented an honorary Doctor of Humane Letters degree." Again, congratulations. We know that your research at M.I.T. majoring on the banjo was the start for your accomplishments in industry, educations, philanthropy, and now following race horses.

Again, we must compliment the M.I.T. Alumni Association for conducting Memorial Services at the M.I.T. Chapel on Alumni Day for all Alumni who have passed away during the previous year. The Alumni Office has informed your Secretary of more classmates who have, sadly, passed on during the last several months: **Harold D. Marsh,** 336 S.E. 49th Avenue, Portland Oregon 97215, died April 28, 1969; Lieutenant Colonel **Arthur E. Howlett,** 1 West Street, New York City, N.Y. 10023, passed away May 3, 1969; Professor **A. Lawrence Kocher,** 314 Burma, Williamsburg, Va. 23185, died June 6, 1969. If any of our classmates can furnish further details about our departed friends, we shall be very much pleased to include such information in future notes. The Alumni Association forwards a letter of condolence to the sorrowing family and your Secretary also sends a sympathy card when the death of a classmate is reported.

We noted an obituary for **Charles Edison** in the August 8, 1969 issue of *Time* magazine: "Honorable Charles Edison, 78, son of a famous inventor, former Secretary of the Navy (1939-1940), and crusading Governor of New Jersey (1941-1944), died of a heart attack in Manhattan. Edison, lacking his father's genius, turned his hand to business and politics—first as president of the family's multi-million enterprise, then an ardent New Dealer. In 1936, he was appointed Assistant Secretary of the Navy, and three years later assumed the full Cabinet post, in which he supervised the Navy's shipbuilding program. Then, as reform-minded New Jersey Governor, he ran head-on into the corrupt political machine of Jersey City and Mayor Frank Hague, touching off a series of battles that paved the way for the adoption of a new state constitution in 1947." To the Edisons we of 1913 extend very sincere sympathy for we share your loss.

We have also received a sad letter from **Clarence W. Brett.** He says: "It is not good news this time. I'm sorry to report that Ruth passed away May 7 after a series of strokes. We came here last August and she said, 'I guess Arizona doesn't like me.' Her daughter lives in Scottsdale, only a few miles away so they were together much of the time. As yet I haven't made any definite plans for the future. I plan to go East for a time this summer but will probably come back home to Mesa for the winter. Hope all is well with you and yours." The Class of 1913 offer our heartfelt sympathy to you; we enjoyed meeting Ruth at our reunions.

We are indebted to **Edward Hurst** writing us and we quote in part. "A letter received from our classmate **Howard Currier** carries the sad news of the passing of his wife Evelyn on July 25 after a long period of painful suffering. Howie and Evelyn were a most devoted couple and close friends of Harriet and I." To Howard we of the Class of 1913 extend

our most sincere condolences for we who knew her, appreciated her love for Howie and her presence at our reunions.

Changes of address have been noted: Joseph H. Cohen 180 Beacon St., Boston, Mass. 02116—phone 617-266-6015; A. Lawrence Brown, 434 Marlboro St., Boston, Mass. 02115; Kenneth A. Scott, 1551 Union Commerce Building, Cleveland, Ohio 44115; Victor Mayper, 324 East 41st St., New York, N.Y. 10017. More news next issue.—**George Philip Capen,** Secretary and Treasurer, 60 Everett St., Canton, Mass. 02021

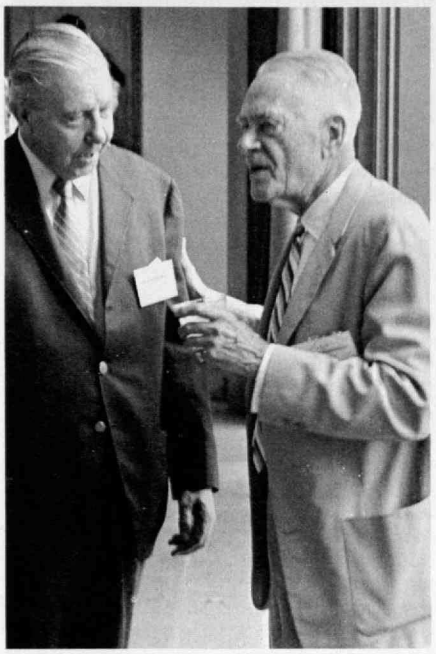
14

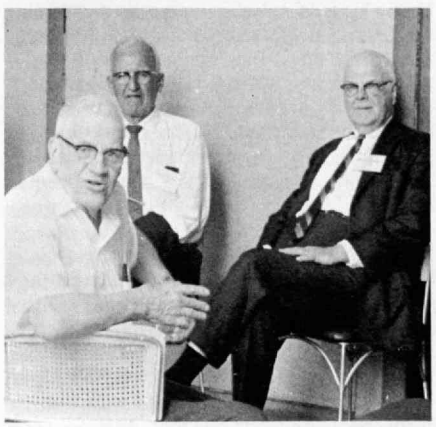
Well the big 55th reunion days have "came and went" and a good time was had by all. Well planned by **Leicester Hamilton** and **Harold Wilkins,** 20 '14ers and 15 wives enjoyed themselves thoroughly. There was little entertainment, as such, but more important was the association, comradery and intimacy that the small numbers permitted. The affair started Friday afternoon, June 13, 1969 and broke up Sunday afternoon. Many stayed over for Alumni Day, Monday, June 16. Except for a meal at a comparatively new restaurant Pier 4 on the waterfront, which incidentally was excellent, all of the remaining time was spent on campus. This sounds a bit restricted but those who have been to Tech in recent years are aware of the many gathering places that the Institute now affords for students and faculty. The general meeting place was the foyer of McCormick Hall which is normally the women's dormitory. Most of the class had rooms there, although a few stayed at Cambridge hotels. There was a special Boston trip for the ladies including the hospitality of the Wilkins' home.

The reunion attendees included: Herman A. Affel, Mr. and Mrs. Henry R. Aldrich, Mr. and Mrs. Homer N. Calver, Mr. and Mrs. Charles H. Chatfield, Thorn Dickinson, Mr. and Mrs. Ray P. Dinsmore, Levi Bird Duff, Walter C. Eberhard, Mr. and Mrs. Linwood D. Faunce, Egbert C. Hadley, Mr. and Mrs. Leicester F. Hamilton, Mr. and Mrs. Walter H. Leathers, Mr. and Mrs. William L. McPherrin, Chester A. Ober, Mr. and Mrs. Roy L. Parsell, Mrs. Ralph Perry, Mr. and Mrs. James B. Reber, Mr. and Mrs. Alden H. Waitt, Mr. and Mrs. Harold S. Wilkins, Mr. and Mrs. Rudolph F. Zecha.

There were other classes holding reunions and our paths crossed occasionally, at one point resulting in a joint revival of the *Stein Song* which most of us had not heard for some time.

We had an official class meeting and election of officers. The existing officers were reelected with the exception of **Elmer Dawson** who asked to be relieved because of ill health. **Leicester Hamilton** was unanimously elected to carry on as chairman of the executive committee which consists of the class officers and the nominating committee of Lin Faunce,





Gathering for a relaxed but none-the-less lively 55th reunion, '14ers enjoyed chatting once again with their classmates as well as their many M.I.T. friends.

Chet Ober, Bert Hadley and Henry Aldrich who had served previously. There was some discussion of the desirability of having a reunion get-together at three- instead of five-year intervals. If some of you who were not able to attend this time have thoughts on the subject, we'll be glad to give them publicity.

Those of us who stayed over on Alumni Day, or Homecoming Day as it is now called, had an opportunity to see a little S.D.S. uprising when they were asked to leave the auditorium platform after overstaying their time and the auditorium had been scheduled for an alumni affair. It was not violent and so far as we could see in general the administration, with Jim Killian and Howard Johnson, has controlled a difficult situation well.

In contacts between members of the group the opening was usually, "Well what are you doing with yourself these days?" The answer usually revealed a surprising amount of activity but not as much golf as one might expect. Some of this activity is in the direction of charity but much is related to jobs which have associated a certain return in the "coin of the realm." **Levi Duff** is in the political field and is County Director of Works, Roads and Bridges in Allegheny County where Pittsburgh is located, **Walter Eberhard** is still teaching drafting at the Franklin Institute.

We still have members of the Class who are going to take it easy in the South. For example, **Louis D. Charm** writes: "Having enjoyed the advantages of the Boston cultural surroundings, and having endured the blustery blasts of the New England winters for the greatest part of my lifetime, I decided one day last fall that my cultural demands have been met and my endurance to face the New England winters has diminished to the vanishing point. So my wife and I packed up and took off by skyway to the land where the Massachusetts legislators go during the winter months at taxpayers' expense to hold seminars and conferences on ways and means to save the Massachusetts taxpayers from the crushing tax burden—the land of sunshine and rain, where I bought a house in one of the new developments."

Attendance at Alumni Day also affords an opportunity to attend the Memorial Services for those who have passed away the previous year. For 1914 this included: R. Howard Annin, Harry J. Baker, Mark F. Boyd, Dean A. Fales, Charles P. Fiske, Earle N. Frank, Herbert H. Hall, Leigh S. Hall, Albert F. Hill, Joaquin R. Maferrer, John A. Root, Dwight J. Stump. These have all been reported in previous news notes.

When we reported the death of **Herbert H. Hall** our story was not as up-to-date as it should have been. Mrs. Hall has kindly supplied further information from news reports and a professional journal which afford additional testimony as to the important position Herb had reached in his field, as engineering expert for the Aluminium Company of America. Herb died last December 6, in Allegheny General Hospital after a brief illness. "He had been an Alcoa employee for 38 years prior to retirement in 1957. Widely known as an international material handling engineer, he pioneered the standardization of freight containers. . . "An entirely new career following retirement—a career devoted to standards that may revolutionize the world's material handling techniques—is the unusual experience of Herbert H. Hall. Mr. Hall is the originator and leader in development of 'containerization' (integration of sizes of shipping containers which will make it possible for goods packed by a shipper to remain packed in the same container until it finally reaches its ultimate destination anywhere in the world, regardless of the method of transportation used)." —**Herman A. Affel,** Secretary. Rome, Maine. RFD 2, Oakland, Maine 04963

15

Hello everybody! Here beginneth the first column of the new season with the hope that you and your families have all enjoyed a pleasant and happy summer. Our annual class cocktail party and dinner was as big and popular and successful as ever, with 55 for cocktails, 35 for dinner and 27 at **Bill Smith**'s after dinner. A good show! The "younger members" of the Class and their families added a lot and were particularly welcome with our hope that they will always join with us. **Barbara Thomas,** really a part of the Class, with her friendly and personable presence, added a great deal to the party's success and was a genial hostess. Bill Morrison served a delicious dinner for us at the Faculty Club led by the Pirates "we are happy" cheer and spirit. On to Bill Smith's later where his lovely sisters Charlotte and Florence and his charming guest, Ruth, served us royally. Long may the Class Supreme wave!

Here's news and bits from friends and classmates all over. **Alice Anderson,** Philadelphia: "Thank you for your invitation to the Class Cocktail party and another year I hope to come. I'll be in Mexico that week." . . . We missed **Phil Alger** but he sent his regards to all with the hope he'll see us at our 55th next year. . . . **Elizabeth Baker,** Middlebury, Vt., "Would you please thank the Class of 1915 for the beautiful flowers for Doug. These, with the flowers from his family, were the only ones in the church, as we had asked for no flowers. This was his expressed wish, as he knew, of course, he could not recover. I am especially appreciative as this tribute from his old friends would have meant a great deal to him." . . . **Bill Brackett,** Duxbury, Mass., "We are trying to have a sort of open house on June 21, but it looks dubious just now. On that date I will have withstood female assaults for 50 years. Our granddaughter, Janice Woodcock, living in Needham, presented us with our fourth great-grandchild. Our third arrived about five months ago in Aspen, Colo. Due to normal circumstances we have, at this moment, four and four-ninths great-grandchildren. The granddaughter in Aspen, Susie, was a Pan American Hostess, (only lasted a year at that occupation and then took on housekeeping). These are all offshoots from our daughter Shirley, who now lives in Ohio. My son Dick has four kids, but not quite old enough to add to the four and four-ninths listed above. Another few years may make a difference." I take it from this, Bill had planned to celebrate his 50th wedding anniversary. What a guy! . . . **Maurice Brandt,** Salisbury, N.C., wrote he would be with us in spirit if not in person.

Buelah and **Earle Brown** returned to Oakland, Calif., from a long stay in Hawaii. "The weather was grand and we hated to come home. It has been cold and foggy here all month. Too uncomfortable to go to the ball games at night but we are going anyway Friday to see the Oakland A's play. I hope you enjoyed the Alumni Day affairs and had a nice visit with those you do not see very often. I am looking forward to the 55th. I wish you both a pleasant summer and lots of fun." . . . **Orton Camp,** Middlebury, Conn.: "Sorry, but once more I have to report that I can not get to the class party. I have a class meeting in New Haven on that weekend. I thought that President Johnson's letter of May 6 deserved an acknowledgement and so wrote him. Am enclosing a copy." I think Orton's letter expresses a general feeling of approval for President Johnson's firm stand against the mild student unrest at M.I.T. in not tolerating force, obstruction or lawlessness.

Ellis Ellicott: "I am very sorry that I cannot be in Cambridge for the festivities this June. Believe it or not, I have a grandson, my oldest, graduating from Franklin and Marshall near here in mid-June and that is where I am supposed to be. I enjoy so much reading in the *Review* your newsy column about good old 1915, and feel that I should be a better contributor of news, but I really don't have too much. Emily and I went to East Africa in February-March on a safari, and it was one of the best trips we ever had. To see those wild animals at close range in their natural habitat was something never to forget. After nearly two years, I have finished writing a history of Ellicott Machine Corporation, which my father, a graduate of the University of Pennsylvania in mechanical engineering in 1884, founded in 1885, and of which business I was head from 1945 to 1966. It was ten times as big a job as I thought when I started it, but I was the oldest employee, at the time of my retirement, and nobody else could have done the older part, because in 1900 a fire destroyed everything, and I had to rely on what my father told me about the earliest days. Give my regards to all."

Francis Hann, Beverly Hills, Calif., "I am sorry to be so far away but some day I hope to see you all." And, we'd all

be glad to see him. **Virginia** (Thomas) **Johnston,** Washington: "We are delighted to have your invitation to the class cocktail party and are so sorry we cannot be with you. Give my love to the Class and have a wonderful time. You can't beat the '15 spirit." . . . Jack Dalton sent us this clip about **Ed Kingsbury** in the New Hampshire Blue Cross *Tidings*. "The Elliot Community Hospital Building Fund Campaign, which set out on December 5 to raise $1.5 million, drew to a close in April with a total of $2,275,367.74 in cash and pledges. The campaign was to raise by public subscription a share of the cost of a five-story, $7 million hospital and medical and health care center on a 30-acre site off Court Street in Keene. The land was donated by Mr. and Mrs. Edward J. Kingsbury, Sr." Praise to Ed for his generosity.

To be with us at the class party, Virginia and **Hank Marion** drove 3,600 miles from Tucson across the southeast corner of Texas and up the gulf coast of Texas. It was wonderful to see them both here, looking and feeling so good. . . . **Herm Morse,** Akron: "Sorry, not this year, but hoping to see you all in 1970." . . . In the middle of May, **Ben Neal** wrote from Lockport, N.Y.: "I was on my usual fishing trip in Canada week before last, which was a bit early, so we did run into a little snow, and holding the rod, with a nice big trout on, with some flakes in your eyes, your hands blue with cold, and the seat of your pants wet, is not one of the greatest joys of life, but it is still fun! The fishing was fairly good, better than last year, but not as successful for me as I would like, because it sorta indicates that I might be getting old, and lost some of my alertness, but I don't think so, if you understand what I mean! I think it was just the luck of a fisherman! I do have a nice whole fish in the refrigerator still to enjoy."

Ruthie (Place) **Hickey,** Pasadena: "I wish we could attend. I'd love Leo (her new husband) to meet the old '15 gang. Love to you and Fran, Hank, Barbara and all the class gang." Nice to hear from Ruthie. . . . **Margaret Runels,** Lowell, Mass.: "Thank you so much for including me among the invitations to 1915's cocktail party. It is good to be remembered. I should love to see you again—and the other '15ers—but I'm going to be in Pennsylvania next week. I hope you and Fran have had a good winter, and are enjoying these beautiful spring days. My very best wishes to all."

Funny **Al Sampson,** of Beverly, Mass.: "The *Review* news was extensive and interesting. Like the old cheese you are you improve with age. Enjoyed your visit and trust you returned to your Cambridge chores with inspired morals and a determination to mend your nefarious ways. There is nothing worthy of note here-abouts. I have had no news from anyone as I presume everybody is scratching around to oblige Mr. Nixon on June 15. I don't know what the future will bring but there is no doubt the levy will be upward for quite a time or until they get it all. I am down to my Piggy-Bank now." Now, when Al has to dig down that deep you know his position is serious, if not desperate. "Help, help for All!"

Ray Stringfield, Los Angeles: "I haven't yet recovered from paying my taxes so I plan to go up in the redwoods to relax, sorry to miss you plutocrats." Ah, me! **Bur Swain,** Southern Pines, N.C.: "Gee, I moved at the very wrong time. Everybody have fun." **Bob Welles,** Altadena, Calif.: "Wish I could be with you all. Best regards." A fine bunch of friends and classmates. How about joining them with a letter for the column? Next month's notes will give you the play by play on our October 24 Boston class dinner at the M.I.T. Faculty Club here. Meantime, all the best to you all.—**Azel W. Mack,** Secretary, 100 Memorial Drive, Cambridge, Mass. 02142

16

Our 53rd reunion is now history, held on June 13, 14 and 15 in that delightful Cape Cod ocean-front setting at Chatham Bars Inn in Chatham, where we have had so many wonderful reunions before (this makes 12, according to **Bob O'Brien,** our vital honorary member and grand arranger of our annual get-togethers).

This time we had the pleasure of celebrating with the youngsters of the Class of 1919, who were out in great, boisterous numbers for their 50th anniversary, and with Harvard's much younger Class of 1949 on its 20th.

It was another sparkling occasion with all '16ers and '19ers gaily decked out in their now-typical red blazers—typical since their M.I.T. inauguration for half-century-ites at our 50th in 1966. There were a total of 38 at our reunion, one more than last year, which raises the question: should we not now ask **George Petit** what the probabilities are, according to his Trend Analysis technique, that we will have 39 next year? We'll let George use his own statistically-derived estimate of the standard deviation of sampling errors when he comes up with his statement on probabilities. Come to think of it, George might even come up with a prize-winning contest for '16ers to see who can come closest in estimating the number in attendance next June. If he does, watch this column for particulars.

Now, getting back to the 1969 reunion, those in attendance included the Walt Bingers, the Harold Dodges, Jim Evans, the John Fairfields, the Ralph Fletchers and sons Jack and Sam, the John Gores, the Cy Guethings, Freeman Hatch, Maury Holland, the Emory Kemps, the Charlie Lawrances, honorary member Bob O'Brien, the Charlie Reeds, Izzy Richmond, the Henry Shepards, the David Shohets, the Francis Sterns, the Hy Ullians and guest Mr. Silber, and the Don Websters.

From the greatest distance came Ruth and **Emory Kemp,** all the way from Sarasota, Fla.—now a 4-day trip in comfort rather than a worrisome 2-day trip as of yore. From the shortest distance came Frieda and **Hy Ullian,** who live right there in Chatham in the summer at what might be considered by some as a convenient bicycling distance from the Inn. For the longest-drive-in-one-day, credit goes to Millie and **Charlie Reed** who used the gas pedal all the way from Washington, D.C. They made the reunion a 2-day stop-over as they wended their way to their summer place in Wayne, Maine where, said Charlie, "This year we'll have a telephone there." Of all the 1916 cars parked around good old Cottage G, one from New Hampshire had the most unique license number, just "Sibyl," belonging to Sibyl Fletcher. We remember from the 50th, that Ralph's license number is MIT16.

Reunion a typical '16 success

As in the past, everything was at its best at the Inn. The cottage arrangements were most pleasant. In the dining room, the food, the college-girl waitresses, and the gracious host and hostess were just the best you can find anywhere. The 9-hole golf course, pampered by genial golf-pro Bill Cotter, was in fine shape for the start of the season. Not many '16ers fiddled with golf but your two secretaries had their annual two part-days at golf. No scores are mentioned but there is good authority for the statement that **Peb Stone** made one 35-foot putt that looked just like the ones you sometimes see on TV. Bob O'Brien was active with the tennis racquet and some of the bouncy '19ers. The near-perfect clambake on the water's edge took care of all three reunioning groups—M.I.T. '16 and '19 plus Harvard '49. And once again, the clambake was even better than the last one—a characteristic of these outdoor events at Chatham Bars Inn. Your secretary was delighted to see at the picnic tables and to hand-shake several past colleagues ('19ers) of the Bell Telephone Labs in New York—Pat (E.G.D.) Paterson, Pete Blye and Mr. and Mrs. Karl Rodgers. Not only were the clams, lobsters, corn-on-the-cob and watermelon outstanding—this was all enhanced by having the same delightful, refreshing collegian waitresses who, at the conclusion, turned entertainers in a dancing, singing set of roundelays with two-accordian accompaniment on the grassy slope above the clambake area. For the Saturday banquet, the clambake and the lunches we had the repeated pleasure of choice wines, served with the compliments of our good president.

The fairly excellent weather for the weekend was most helpful, with a lifting of the morning haze by 9:00 or 11:00 a.m. In the after-haze brilliant blue sky, the atmosphere around the Inn and its cottages was influenced uniquely by a number of things such as, the woodsy odor of pine needles, the slipperiness-under-foot around the tough and hardy scrub pines, the wild roses (under the cottage windows) that opened and closed seemingly

C. S. Reed, '16 took the above photos at the Class of 1916's 53rd reunion on Cape Cod. Familiar Cottage G at Chatham Bars Inn (left) served as class headquarters while the shoreline provided the setting for the traditional clambake and entertainment (center) by the waitresses. Ralph Fletcher, President of the Class (right), was obviously enjoying himself.

at will, the cool ocean view of deepest blue way out to the horizon, and the call of the bobwhites that small boys, and some big ones, love to imitate. From all this it should be easy to understand why we always like to return to Chatham.

Activity-wise there was really not too much doing over the weekend. A number of items come back to us, including some from Bob O'Brien and Jim Evans. The spacious parlor of Cottage G was, as usual, the meeting place for all formal as well as informal gatherings. Included in the displays there, were: **Ralph Fletcher**'s birthday-card album prepared by Sibyl for showing the entire 118 classmate cards and notes sent enthusiastically to our President on his last birthday, November 24; two sets of Boston and M.I.T. clippings of June 1916, one set from **Steve Brophy**'s records (sent to us by Jessie Brophy) and a second comprehensive set from **Paul Page Austin** of San Francisco; a set of Steve Brophy's dance-cards of the 1915-16 era with names for individual dances at various class social events; a copy of the new (1968) book just published by **Herb Gilkey;** a collection of picture post-cards received by secretaries during this past year; folders of photographs and news clippings for previous reunions; and the customary bulletin board with last reunion photographs, newspaper clippings and photographs, and high level news items of '16ers since the 1968 reunion, as collected by your secretaries for reunion showing and for inclusion in the class record folders.

Following an extended meeting of the Executive Committee, a class meeting was held in Cottage G to discuss class items. A principal item of strong agreement was that the class should speak up "for" the Institute—for a policy of continued advanced research on national defense projects. Later, in a light-hearted moment, **Maury Holland** presented a gold toothpick to **Ralph Fletcher,** as appropriate for "a man who has everything," using words somewhat as follows: "What this country needs now is leadership, not from Washington but from the grass roots where the nation grows. We have all had a half-century of growing, travel, raising families and building businesses. . . . When the charter was brought across the Charles River in 1916, Mother Tech was in business in the Golden Age of Technology. Ralph put it to work in Fletcher granite; the 1966 class picture shows **Joe Barker** with the Golden Fleece and **Van Bush** with his pipe. These are the golden moments of a lifetime. It is appropriate to present our president with a bit of gold in the form of a toothpick."

Other items of interest include the shopping and nearby sight-seeing trips of some of the ladies (Reed, Stone, Dodge, Guething) with Cy Guething as chauffeur. Dolly Stone lost her wallet in one of the stores in Chatham, went back and inquired in one store where some shopping had been done, and sure enough!—the wallet was there and nicely returned. For all, a wonderful feeling—shopping in a pretty homey town where lost wallets are just naturally returned! That's Massachusetts for you, or rather, that's Chatham for you!

There were many cosy little places to swap stories and just talk. According to one source, Ralph explained to one small group his latest ingenious invention, "Big Dick," based on the expanding and sliding wedge principle—it splits off granite slabs of several tons, clean as a whistle, we understand. We must get more information for our class notes. Chatham and vicinity is noted as an excellent area for walking—again, **Izzy Richmond** is said to have taken the most and the longest walks. Cy Guething and your secretary got up early mornings for medium-length walks along the shore, and were rewarded one morning by the sight of a 25-pound striper that had just been caught in the nearby waters. A couple all the way from Providence made the catch and Cy engaged them in knowledgeable fishing-talk. As for dancing in the evening in the Inn, some onlooking '16ers and '19ers were heard to comment on Dolly Stone and her dancing, "Such pep!" From all this, we hope we have helped you to understand why you really should attend the class reunions. To ease the travel problem in the future, consideration is being given to the possibility of holding our reunions in mid-week instead of on weekends.

We regret to report the death of two classmates this past summer. **Larry** (Laurence H.) **deLabarre** died in New York on July 25 after a long illness. In early May, a card with several signatures was sent to Larry by Peb Stone from the 1916-17 luncheon at the Chemists' Club. A reply written for him at the hospital by R. E. Snyder on May 22 read: "Thank you for the wonderful card you all sent Mr. deLabarre. He surely remembered all of you as I read your names to him. The card is now posted in his hospital room. He is still in the hospital suffering from pain due to the broken hip and it having to be re-set since the first pins did not hold securely. He is not in good condition." And on July 26, **Howard Claussen** wrote: "He was an invalid for years. There was no hope, cure or relief for him. Couldn't write, walk or do anything but look at TV from a wheel chair. I wrote him frequently and sent him cigars, his only relief." We do not have a story on Larry at this writing (August 9) but hope to have it for a later issue.

Ted (Theodore C.) **Jewett** died in Buffalo on June 24. We always thought of him as "Mr. Buffalo." His very active career in Buffalo is so clearly set forth in a Buffalo newspaper of June 24, we will quote from it almost completely: "Theodore C. Jewett, 76, active business and civic leader for 11 years after he officially retired, died today, June 24, 1969. During a 53-year business career he had held supervisory posts in four major companies here. Mr. Jewett was a patient for five weeks in Buffalo General Hospital where he had been a board member for more than three decades. A past trustees chairman, he currently served on five hospital committees. Children's Hospital and the Albright-Knox Art Gallery also owe part of their stature to Mr. Jewett. He was a member of the advisory board of Children's, where his son, Theodore, is chief of surgery, and was active in the current long-range multi-million-dollar expansion drive. A lifelong resident of Buffalo, Mr. Jewett graduated from the Massachusetts Institute of Technology. In 1917 he became plant engineer of the J. H. Williams & Co. Two years later he joined the Larkin Co. where he became vice president and operating superintendent. He became associated with Spencer

Kellogg & Sons Inc. in 1938 and took on the responsibility for operation of the company's mills and production. He served first as chief engineer and then as general superintendent. He was elected a director in 1941 and became a vice president in 1946. He was elected a trustee of the Erie County Savings Bank in 1947 and a director of the Barcolo Manufacturing Co. in 1951. In 1958, he retired from Spencer Kellogg. But in January 1959, he quit retirement to join the International Railway Car Leasing Co. and to become vice president of Morrison Plan Inc., an affiliate of the Morrison Railway Supply Corp. of Buffalo. 'I'm going back to work,' Mr. Jewett commented at the time. 'I've loafed for six months and that's long enough.' In recent years, he became well known for his help in efforts to strengthen resources of Buffalo and the Niagara Frontier. In 1958, he became chairman of the new Business Development Committee of the Buffalo Chamber of Commerce, organized to promote the area as a place for industries to locate.

"In 1959, Mr. Jewett became president of Buffalo Industrial Park, Inc., a post he held until this year. Five generations of his family, including children and grandchildren, belonged to Westminster Presbyterian Church. He had been an active member since he was 14 and served as trustee, deacon and elder. A year ago he was made an elder for life. Mr. Jewett currently was a member of the Pack Corporation and the Saturn, Clarksburg Country and Midday clubs. Surviving are his wife of 51 years, the former Alexandra Kent Costikyan; two sons, N. Holland Jewett and Dr. Jewett; a daughter, Mrs. Theodore C. Prentice, and 11 grandchildren."

Charlie Walter of St. Petersburg, Fla. wrote us just before the reunion: "We enjoyed the picture of last year's reunion (a good-looking group) and my only sorrow is that Alice and I will not be able to attend this year. There is nothing very exciting to write about from St. Petersburg where we spend most of our time. We manage to keep busy around our home with the lawn, gardening, BUGS, etc. Other pastimes are square dancing, walking and swimming. Our families are in Maryland and California. We are not much for traveling these days so we expect visits from them pretty soon. Again, thank you, and please extend our best wishes to the class for the best reunion ever. Everybody have fun!"

In late June, we had a nice quickie message from **Ray Brown** in Niagara Falls, N.Y. that read like this: "What do you know—met Helen and **Bill Leach** at a cocktail party here in Niagara Falls the other day! They both seemed fine." Then Ray went on with some summer health advice like this: "Glad you have all of July at the beach. If you like to jog a little, try it at about half-tide, in the sun, barefoot, no shirt—sand will probably be a little squishy but not sloppy." May we report that we did all that except the jogging!

After the reunion we had this word from Gyps and **Cy Guething** in Boothbay Harbor, Maine, their new, or fairly new, vacation love for summers: "Didn't we have a nice time at the reunion? After leaving Chatham, we came almost directly here to the Spruce Point Inn. The sun heats the unheated salt water pool up to 67° from the bay temperature of 60°—just right. We had hardly settled when Mil Reed called and invited us up to their luxury camp on Androscoggin Lake for lunch. Charlie and I really killed one of her bubbling-over cheese souffles and they didn't have to wash the salad platter either. Then the Reeds came down here to Boothbay before leaving for other parts for the month of July. They return in August and we will see them then."

The **Merrick Monroes** too write from Maine, from an address that reads Bear Mountain Lodge, Harrison, Maine, where they are to stay until early September: "Our house here is about 75 years old—an old farmhouse shows on an old 1856 (or maybe 1843) map, not 'geodetic survey.' The bugs have been very bad and we have not even approached the lake. My wife has been killing poison ivy in the field—it's never been touched and has probably been undisturbed for 50 years, plus or minus. We have tentative reservations for the freighter trip this fall. If you get up near the White Mountains this summer, come on up or down—we'll tell you how to do it."

In June, **Art Caldwell** moved from New York City to his new apartment at 47-08L Meadow Lakes Village, Hightstown, N.J. 08520 (same location as our Elizabeth Pattee), and likes it very much. He says: "Barbara is here in the Nursing Care Center where she has been since last September. Her condition has improved considerably." All our best wishes, Art!

From Naples **Rudi Gruber** sent this message late in July: "This is the villa of my (late) brother whose son I am visiting. I drove to Napoli from Genna, via Pisa, Florence and Rome, with one of my Gruber-nephews at the wheel. The Nobelprize Laureate convocation in Lindau, week of July 1, was most interesting. Several U.S. medical scientists took part. Will be back 'stateside' late in August. Hope you have a good summer."

We have much interesting correspondence with **Jack Camp** in Mexico City, who is also sometimes worried about "things." One letter notes: "I agree with Herb Mendelson's remark about 'change and progress.' [Herb was heard to comment in 1966 or 1967: "It may be change but is it progress?"—Sec.] In fact most of what is going on in this old world today is indubitably change, but I have yet to find anyone calling it progress."

After you-know-when in July, **Vert Young** of Bogalusa, La., the rock-hound of the Class of 1916, sent us this brief report, which sure enough sounds like Vert: "Have just been watching on TV what may go down in history as the greatest rock-hunt of all times! The purple rock mentioned could have been purpurite, stichtite, amethyst or hexagonite—maybe purple apatite which is very rare, or purple fluorite, which is not so rare. Those are all the purple rocks that come to mind."

So there's our story for the current month, principally about what went on at the 53rd reunion. Vacation schedules of your secretaries have prevented us from sending out the usual news-gathering letters in time to meet the required schedule for this issue. But watch the next issue for news, including word from Howard Claussen, Francis Stern and Ted Strieby. Now, as we've said before: to keep this little old column full and interesting, write a little but write often to your willing-to-work secretaries. Let us know where you are, wherever you are; what you're doing, whatever you're doing; and give us some bits of your philosophy, whatever your philosophy.—**Harold F. Dodge,** Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046; **Leonard Stone,** Assistant Secretary, 34-16 85th St., Jackson Heights, N.Y. 11372

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"This issue of the Review will be coming off the press just before our Northfield reunion so that most of you will be reading these notes before October 8. Let's make our 52d reunion the best ever and this depends on you. Please make a special effort to come. We plan to announce another important class project on this occasion.

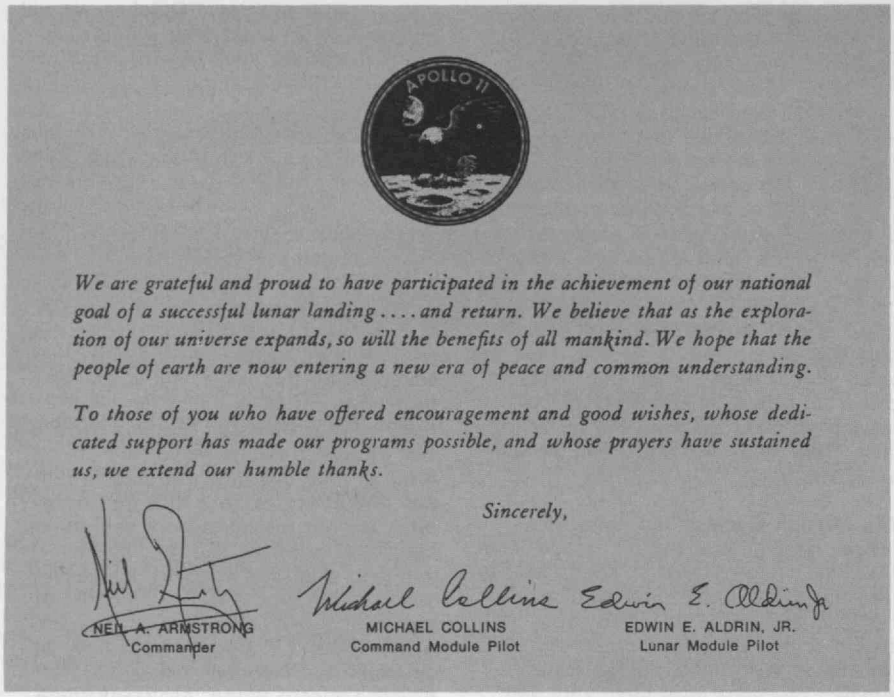
"We are still basking in the glory of the magnificent achievement of *our* classmate Buzz Aldrin. Our congratulations and gratitude go to all the Aldrins includ-Ed senior.

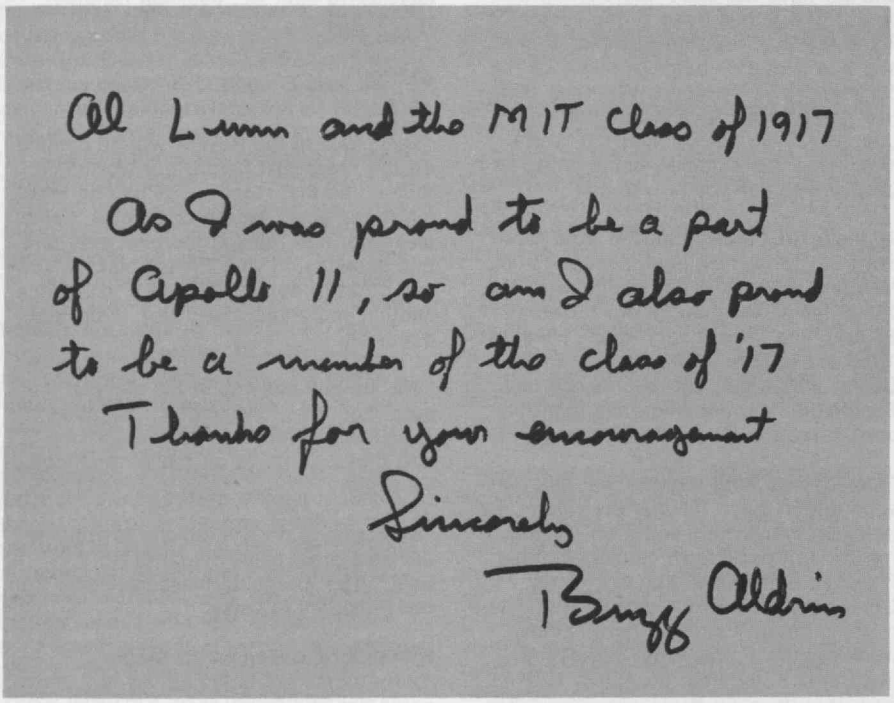
"Sue Lunn and I are looking forward to seeing a great many of you at Northfield." The foregoing message came from our President **Al Lunn.**

Hurrah for the Man on the Moon

As the notes are being edited, the astronauts are still in quarantine. The seemingly impossible dream happened when the Apollo 11 made it to the moon and back, carrying, along with two others, our **Buzz Aldrin, Jr.** Jules Verne has been vindicated—but wonder if even he imagined that TV could send pictures of the landing to all the world, and that it would even be possible to collect a telephone call from the President to Armstrong and Buzz while walking on the moon. A Britisher won a 1000 to 1 bet tax free—Buzz, when next in good old England, trust he gives forth at least a sip of Pimms' #1. Wonderful indeed, and '17 en mass arises to give a HURRAH for our Buzz and his illustrious father, our **Edwin E. Aldrin, Sr.**

A very pleasant time was had on Sunday, June 15, when Al and Susan Lunn, as-





sisted by their daughter Jean, had a red jacket 'at-home' for members of the Class. Many invitations were sent and the following enjoyed being able to attend: the Beadles, Childses, Dennens, Dunhams, Dunnings, Ferrettis, Fords, Lanes, Ray Stevenses, Strouts, Don Severances, also Nelson Chase, Jim Flaherty, and Joe Gargan. Jim Flaherty presented Katherine and Ray Stevens with a lovely water color he had made of some detail on the front of the main M.I.T. building as seen from the Great Court.

In addition to the above, the following were present at the Institute for Alumni Day; **Ray Brooks,** who came via Denver where he was attending a meeting of the Dedaelions at the Air Force Academy, Penn Brooks, the Hunters, and Tubby Strout's grandson William Dunbar. Incidentally, the Lunns have had their first grandson, the first grandchild being a girl.

Mrs. **W. B. Newell,** (Pete) tried to be present at the Memorial Service: " . . . very sorry my daughter and I missed the memorial services on June 16. Our car broke down in a small town in North Carolina on our way up, and we had to wait over from Saturday until late Monday afternoon. I called M.I.T. on Monday morning."

Claudius Henry Maston Roberts, 74-year-old veteran of both world wars and Korea, died at his home in Syracuse on June 25. A retired executive of the Pass and Seymour Co., retiring in 1962, he had also served as vice president in charge of research for the Petrolite Corp., of Los Angeles from 1922 to 1941.

During W.W. I, Colonel Roberts served as a pilot with the LaFayette Esquadrille Unit; during W.W. II he was with the office of the chief of ordnance. Then under George C. Marshall, Army Chief of Staff, he was twice ordered to the Pacific on confidential missions. Colonel Roberts was personally responsible for the development of the VT Artillery Fuse. His decorations included: Legion of Merit (two Bronze Oak Leaf Clusters); Army Commendation Medal; Armed Forces Reserve Medal (two ten-year devices); W.W. I Victory Medal (three battle clasps); Army of Occupation of Germany Medal; American Campaign Medal (three Bronze Service Stars); W.W. II Victory Medal; National Defense Service Medal; Korean Service Medal; United Nations Service Medal; and from England, Most Excellent Order of the British Empire (Honorary Officer).

Surviving are his wife, Mrs. Lida Adams Roberts; Miss Patricia Roberts, his daughter; Samuel A. and Thomas S. Roberts, his sons; and a grandson. Memorial services were held at St. Mark's Episcopal Church in Syracuse and burial with full military honors was in Arlington National Cemetery.

Leslie S. Ray of Topsfield, Mass., passed away May 13.

The **Ken Bells**, after four years, have forsaken Majorca (Mallorca) but keep on the move. In November 1968 they stopped with the **John Holtons** at Skaneateles, N.Y. Ken and Vera met at the Holton's wedding. While visiting the Holtons they had an interesting trip to the Corning Glass Company Works. At Christmas time they stayed in Swarthmore, Pa., visiting the **Charles Venables**, at Wallingford, Pa. Charlie is fine except for some arthritis.

He was raised in Chapel Hill, N.C., so was able to advise the Bells about living quarters there, where they anticipated wintering. Then it was on to Florida where good visits were had with the **Ray Stevenses** at Maples, and the **Ken Lanes** in Miami. At Winter Park, Ken had a good chat with **Al Hegenberger.** At Chapel Hill they found the atmosphere of the University of North Carolina and the town very enjoyable. They were saddened by the tragic death of their oldest grandson, Steven Scott, who was killed in the second airplane crash at Bradford, Pa., as he was returning to college.

Bill Dennen mailed a letter from Margaritas, Mexico, enroute to the Fiesta in Mexico City, "I found your note when I reached here yesterday. Went across country visiting boys on way and spent three weeks in Rolling Hills Estates in California with Dick. The Cornishes came up from Mexico City and drove back with us via Las Vegas and the Grand Canyon. Nearly got caught in a snow storm there. It took 10 days on the road to here. Nothing jelled on the freighter trip, but

we are still in hopes. Will step on the class contacts when I get home."

Cliff Lansil, 48 Oakland Ave., Arlington, Mass., writes: "I have quite an uneventful, but contented life, which probably would be of little interest to anyone. From graduation until 1945 I was a member of the faculty of M.I.T. in electrical engineering. I then changed to the commercial field and took a position as development engineer for the Gamewell Co. My work was in the design and testing of police and fire alarm equipment. I retired in 1964. My wife and I have three children and four grandchildren. We have a summer place on salt water at Falmouth, on the south shore of Cape Cod. I have always liked the ocean, it is in the blood I guess, as most my ancesters were sea captains, and I have managed to be on it for more than 50 years. I also manage to find time to get a rating of Navigator in the U.S. Power Squadron and have for some years taught the weather course for the Charles River Squadron." (More to come in a later issue.)

Ken Childs advises: "The reunion at Sturbridge last October is about as far away from home as I have been all winter. Both Gladys and I have had good health except for the arthritis that has bothered in the past 5 to 6 years. The biggest event this winter was the open-house we held in February, celebrating my 75th birthday. About 35 neighbors and friends attended including six of our seven grandchildren. This winter we have looked over travel folders, and have decided on a cruise in July to Montreal and Bermuda. As soon as the snow disappears, probably a visit around the yard will also be in order. Really, it does not take much activity to keep me busy."

E. G. Senter, Jr., 4302 Hall St., Dallas, Texas 75219 reports: "At the request of Dick Lyons I am sending the following news item. At 77 am still oiling and real-estating in a very limited way. No travels except to local farms, and no visits from classmates, all too far away. No wives, children or grandchildren. Most interesting experience has been the efforts of an engineer—myself—to farm and produce crops which the world needs; but distribution is difficult, costs high, and profits nil." More power to you Ras, hope to see that cowboy outfit at our 55th.

Roswell E. Pfohl, 2012 East River Road, Grand Island, N.Y. 14072, writes John Holton as follows: "I am sorry this has been so long in getting to you, but it just came to the top of my desk today, April 11. I opened my office in Buffalo for the practice of architecture in April, 1925 and was hard at it until I entered semi-retirement in 1963. During these years I have taken trips with my wife and family including Mexico, Canadian Rockies, and Northwestern U.S., Europe, Nova Scotia, etc. For many years the major portion of my practice has been in the design and supervision of construction of school buildings. At present, we are supervising the construction of a Federal G.S.A. building in Buffalo; a new City Court Building, which we designed as well, and work at the State University of New York at Buffalo. Mine has been a rich life with two sons and one daughter, who have in the last nine years presented my wife and me with 11 grandchildren."

Dave Waite advises: "The only news I have about the Waite family—Marg is O.K., 'Primrose Garden' is well covered for winter, my daughter is remarried and lives about a quarter mile from us, this is great. Oldest granddaughter lives nearby with four great-grandchildren, three boys and one girl. Number two granddaughter graduated from Connecticut College in June and was married the same month. Number three granddaughter is at Dennison College in Granville, Ohio. She is a Spanish major, and will spend her junior year in Spain."

Public health honors

Professor **C. E. Turner,** 19 Village Lane, Arlington, Mass. 02174, writes Brick Dunham as of March 31, enclosing a printed Curriculum Vitae. Copies of same will be sent on request. It ends with heading 8 "countries visited" and lists 77. Where to now? In the meantime you are appointed the "most travelled '17er of record." "It was very gracious of you to add a long hand personal note to your recent class communication. Perhaps you can draw up something from the following. Clair Turner is living in retirement. He has recently received two honors in the public health field. One was the Lemuel Shattuck award from the Massachusetts Public Health Association. The other was the election as honorary president of the International Union for Health Education. He had earlier received the Gold Medal of the Academy of Medicine of France, and the Great Cross of the Order of Merit of the West German Republic."

Address changes: Franklin C. Dexter, 460-A Portsmouth Drive, Leisure Village, Lakewood, N.J. 08701. Mrs. Clarence (Mayatha) Holt, 11225, 82nd Ave., North, Apt. 106, Seminole, Fla., 33540.

Alan P. Sullivan, Bissell Rd., R.D. 2, Lebanon, N.J. 08833 writes: "Your request for assistance in obtaining material for class notes from several '17ers in New Jersey caught me at a rather bad time for prompt response. We had just decided that the maintaining of our present residence and the pursuit of our hobbies, with the degree of involvement heretofore, had become too much for us. We therefore decided to sell our present place and move out with our son. Consequently we have been very busy disposing of the house, building an addition to the Lebanon place, packing and getting ready to move. We hope to make the move about September 1, and once we are settled I hope to be able to render the service you have requested. I hope to continue my hobby of collecting and restoring antique clocks, but to a much lesser degree than heretofore. As for Olive, she will have several acres to play with at gardening, but will have the help of our son, who contrary to myself, likes that sort of thing. Come October, we will be ready for a vacation so will have a good excuse for attending the 52nd reunion at Northfield, Mass."

Our industrious chairman of the Reunion, **Dud Bell,** (he did such a good job at the 51st he was appointed again) writes as of July 13, "I am now on my usual fall trip and about 20 miles south of Pittsburgh in a good motel. Helen is feeling fine. Then I fly to North Carolina to attend a big jobbers convention and on my return I am heading up into New York state where I can run over to Northfield Inn. I have the acknowledgement of my last letter and except for many details, we are fixed up for confirmed reservations for October 8 to 10. Perhaps Dix is on the right track, about three days, but I think the extra day or even more, should be left to the boys who want them. With my work, I just don't have the time, as I have to fly to Chicago on Saturday following the 10th, which makes a rush back home."

At the last luncheon in New York City in June prior to the summer recess were, Clarence Seely, Dick Loengard, and Dix Proctor—Bob Erb, Ray Brooks, and Ed Aldrin reported in absentia; '16 outnumbered us by two, but it was most fitting listening to our elders. Art Caldwell, '16, advised he was retiring to the Presbyterian retirement complex in Hightstown, N.J. just off the New Jersey Turnpike exit 8. Can report Art has an ideal apartment.

We have 318 classmates including the honorary ones. Now is the time for all good members of the party—class solicitors of news—to come to the aid of your secretaries.—**C. Dix Proctor,** Secretary, P.O. Box 336, Lincoln Park, N.J. 07035; **Stanley C. Dunning,** Assistant Secretary, 6 Jason St., Arlington, Mass.

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In these turbulent days on campuses everywhere, there is something reassuring when constructive action is the order of the day—especially when it takes place at M.I.T. A protest arose this spring about the involvement in research by M.I.T. for the United States Defense Department and other war-oriented sources through its Instrumentation and Lincoln Laboratories. The challenge was met by the Pounds Committee, 22 people representing all shades of opinion, including students, faculty, administration and alumni. After a month of intense study, they filed a report signed by all of them in substantial agreement on its conclusions that M.I.T. should retain and operate these facilities, while making greater efforts to increase research projects in non-war-oriented services. We can take pride in this innovative method of handling a major crisis by involving the entire M.I.T. family in its solution.

It is natural that fellow alumni and fellow classmates do not see eye to eye with

the M.I.T. faculty, student body or administration on every issue and problem, particularly when the opinion expressed is that of an individual and not the official position of M.I.T. More than once such disagreement has resulted in a threat to cut off support for our Alma Mater. My appeal to our alumni dissidents is simple—let us follow the example of the Pounds Committee and let us agree that M.I.T. is doing a unique job in educating leaders for the future. Let us work out our differences between ourselves, and with our enthusiastic support, make M.I.T. stronger than ever.

Our most exciting news for this issue is a story about our own **Ted Wright** based on a full page feature article in the *Ithaca Journal* of May 24, 1969.

Fifty years ago last May 27, Theodore P. Wright, Jr., then Lt. U.S. Naval Reserve Flying Corps, completed the first successful transatlantic flight in history. His NC-4 fragile by today's standards, was built by aviation pioneer Glenn Curtis.

On May 8, 1919 three NC's affectionately called "Nancies" by all associated with them, took off from Rockaway Beach, New York, for Newfoundland, the jumping off spot for their flight toward the final destination, Lisbon, Portugal. Only Lt. Wright's "Nancy", nicknamed The Lame Duck after being forced down at sea only four hours after take off from Rockaway Beach, finally reached Lisbon.

Flight time for the crossing was 25 hours and 1 minute with an elapsed time of 11 days. Ted and his trusty Lame Duck later flew on to Plymouth, England, for a hero's welcome there.

The Ted Wright story amplifies this note from **Mal Baber,** Hilton Head, S.C.: "The extensive peregrinations of the various peripatetic members of our Class leave me somewhat breathless. I feel practically immobile. None the less, after several visits, we have settled on this spot for vacations, and have bought a so-called Cabana which we are now opening. Actually, as most of our furniture had failed to arrive, our recent living is somewhat Spartan.

"As you probably know, this year marks the 50th Anniversary of the first transatlantic flight and the NC4 is currently on exhibition on the grounds of the Smithsonian Institute in Washington. If my memory is correct, our classmate, Theodore Wright was on duty in the office of the I.N.A. at Garden City when the NC4's were built. I am sure he can give an interesting story if you can pry it out of him.

"We will be returning to Philadelphia next week for the rest of the summer—hopefully to get away in the fall. Jean joins me in regards to yourself and your charming wife. I personally appreciate the time and effort you are devoting to being an outstanding class secretary. But then 1918 was and is an outstanding class."

Another of our world travelers is **Ted Braaten** who reports: "We were forced to cancel our planned freighter trip to Amsterdam via the Caribbean and South America this spring but were fortunate to obtain last minute reservations on the *Cristoforo Colombo* which sailed from New York on February 25 arriving in Trieste on March 11. We travelled by bus along the Adriatic coast to Split where we explored Diocletian's Palace, then on to Dubrovnik where we spent 10 days and climbed all over the old walled city. In Sarajevo we traced the fateful route of the Austrian Arch Duke Franz Ferdinand from the city hall to the bridge where he was shot by Gavrido Princep on June 28, 1914. We found Belgrade a very busy, prosperous and modern city. After the month of April in London we returned on the new Q.E. 2 on her maiden voyage from Southampton to New York. Our reception by helicopters, fire boats, tugs, excursion boats and numerous other crafts as they escorted us into New York harbor is something we shall never forget."

Ted made reference to **Tom Brosnahan** whose frequent travels never quite satiate his intellectual curiosity. I am also indebted to Tom Brosnahan for a copy of the June issue of the *Variety Department Store Merchandise.* In this issue, Tom has analyzed the reports for 1968 of 16 large chains. His company, S. S. Kresge Company, led the field for increase in sales over 1967 by a whopping 24.96 per cent. No wonder you are able to travel, Tom. More power to you.

Jack Poteat reports he and his Betty were at Connecticut College in June. She is Chairman of Hospitality for her 50th next year and wanted to see how 1919 did it. They just returned to "Shangrila," Tryon, N.C. after five weeks of driving and visiting friends and relatives. Their daughter and her three children returned with them for a month's stay. He writes, "You may be sure that there is lots going on with three kids gallivanting about the place. Fortunately, the swimming club takes them practically every afternoon, and works off lots of their energy so they sleep late in the morning, and Betty and I can get our breakfast in peace before they begin to swarm." Inadvertently, the final installment of the Poteat's around-the-world trip last year was omitted from the last issue. So with apologies, here it is and I know you will all enjoy it.

"New Delhi with its wide boulevards, beautiful embassies and stately government buildings is a far cry from Benares. It is more like a European city and the British influence is evident everywhere.

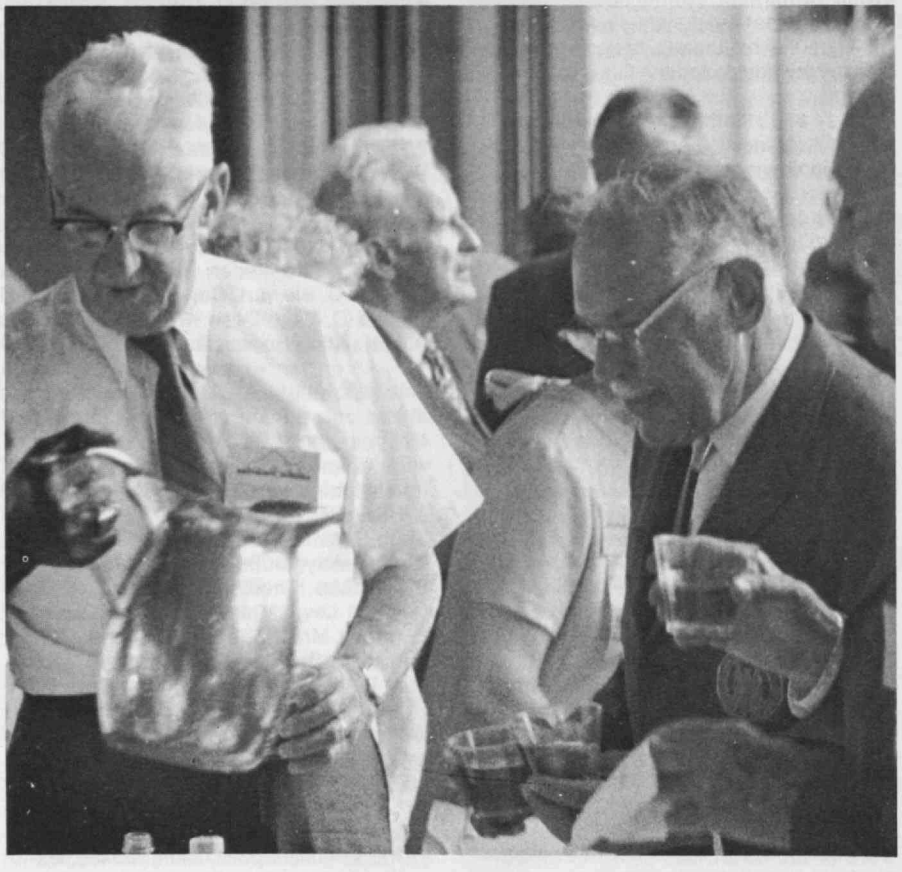
"In one of its museums we saw ancient central Asian murals that had been recovered from monasteries. We visited several spots that harked back to the Moghul rule but modern influence is transforming New Delhi. We drove from New Delhi to Agra, to Jaipur and back to New Delhi. Our driver was a Sikh with his turban and vandyke beard.

"We were apprehensive about our visit to the Taj Mahal for fear it wouldn't live up to its billing. Our guide was very wise—he said, 'You should visit this monument without any conversation to distract you.' So he briefed us at the main gate and left us to go to the Taj alone. There were several other spots in Agra that we visited but the incomparable Taj Mahal stands out.

"We arrived in Tehran from New Delhi by plane, just after midnight. When we arose in the morning we were looking out at a magnificent view of the snow-capped Elburz mountains only a few miles away. Tehran is a very large city, the center of government and economic life of this, one of the oldest continuous empires in the world. Being a Moslem country, many women wear the 'chador' over modern dress and it isn't unusual to see the women hold it in place with the teeth, so the hands are free for carrying things. While the newer parts of the city have wide streets, traffic jams are common. And it is not unusual to hear, over loud speakers, 5 times a day, the call to prayer.

"We were told that the Shah's mosque at Isfahan rivals the Taj Mahal in beauty. So when we flew over barren, treeless and waterless desert, 250 miles south of Tehran to Isfahan, we were eager to make our own comparison. Incidentally, the hotel at Isfahan, the Shah Abbas, was named after the Shah who built the great mosque and who unified the country in the 17th century. The hotel is built on the site of an old caravanserie and around an ancient garden, which, when lighted at night is a true Arabian nights picture. It was in 1592, when Elizabeth I was ruling England, that Shah Abbas named Isfahan as his capitol. It was much larger than London then. Our visit to Iran was during the celebration of Ramadan and so we saw many of the faithful enter the mosque, wash at the courtyard pool, and prostrate themselves toward Mecca. They also fast during this period, refraining from food during the day only. If the great court within this mosque was a beautiful garden or was covered with those matchless Persian rugs, the comparison to the Taj Mahal might be more favorable. But beautiful as it is with its shades of turquoise in mosaic tile and yellow trim, we still vote for the Taj Mahal. Being at 5,500 feet elevation it has a salubrious climate and with irrigation, many fruits and vegetables grow here. Pomegranates are plentiful and its juice is a lip-smacking breakfast drink.

"But Shiraz is beckoning, another 250 miles south, but still on the 5,000 foot plateau. It was the home of the two great Persian poets—Saadi and Hafiz. Their mausoleums are places of repose and almost of worship for the people of the city. To them, Omar Khayyam has no standing as a poet but only as a mathematician and as anti-Moslem. His wine, women and song theme is contrary to the teaching of the Koran. Shiraz is a city of 300,000 without a railroad and resting in a desert. But it has a good climate and is



From the serious business of commencement to more informal reunion functions on both the campus and Cape Cod, June 12 through 17 proved a truly memorable occasion for those taking part in the Class of 1919's 50th reunion.

making progress. It has fine hospitals, a very modern university complex under construction, a 4-lane highway well lighted from airport to city and yet there are older and primitive areas. Shiraz is the jumping off place for a visit to Persepolis. Cyrus the Great, remembered for his liberation of the Hebrews from Babylon over which he ruled in the 6th century B.C., picked the site for Persepolis as a Ceremonial City. But Cyrus died in 529 B.C. before construction could be started. It was Darius I who began to build, not with brick which disintegrates with time, but with stone, hewn from the great cliff behind the site.

"After another night in Tehran, we boarded a plane for London, touching down at Beirut and Frankfurt. London was typically overcast and misty. A friend from Manchester came down to visit us for a couple of days. But we were glad to board a Pan Am plane for Philadelphia December 7. After two nights with John and family and a phone call to Sally and family, we flew home two months to the day after leaving Tryon. We were glad to be home. But how inadequate this journal of place and event. In the telling, many other things just as fascinating and impressive had to be omitted. But we still glow in the remembrance of the trip as a whole and the lovely folks that we met."

I am happy to report that Dorothy and **Ed Rossman** have returned to Paris Hill, Maine. Ed has made a good recovery. He is going in for a minor operation in the next few days and we look forward to seeing him shortly after Labor Day.

I list new addresses as follows: Julian M. Avery, 47 Old Orchard Rd., Chestnut Hill, Mass. 02167; Theodore A. Pierson, 12344 Old Hassan Rd., Jamesburg,N.J. 08831; Walter T. Biggar, 46 Wayside St., Springfield, Mass. 01118; and my own new address shown below.

Because of mail returned, Harold W. Blount, Kiver L. Honek, and Carlos Godmogil are assumed deceased.—**Max Seltzer,** Secretary, 60 Longwood Ave., Brookline, Mass. 02146

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The 50th reunion, June 12 to 17, 1969, was a great success with 65 classmates and 50 wives making the trip back to M.I.T. in Cambridge and the weekend at Chatham Bars Inn, Chatham, Mass., on Cape Cod. Things moved pretty fast. Everyone gathered and checked into McCormack Hall on Thursday afternoon, June 12. The carnelian jackets were picked up at the Student Center, and from then on it was easy to spot a '19er from any distance. The very pleasant reception and buffet dinner at McCormack gave everyone a chance to say "hello," and visit a bit. Continued visiting followed on the roof of McCormack where drinks were also served. It was a hot evening and very comfortable on top of this girls' dorm—fine views in every direction.

Friday, June 13, was commencement day for the Class of 1969. Our Class, the 50-year class, got "dressed up" in caps and gowns, and led by Marshall **Don Way** marched in the procession which ended on the stage at Rockwell Cage. Here we witnessed the handing out of some 1,139 degrees by President Johnson who then gave the graduation address; there was also a short speech by Massachusetts Governor Francis W. Sargent, '39. The day was very hot and the well insulated caps and gowns added to our discomfort during the long ceremonies.

This morning ceremony was followed by a luncheon in the Great Court. The luncheon program included a speech from the 50-year class to the graduating class which was given by your secretary, **Gene Smoley.** The newspapers quoted him briefly. "Our class had no commencement, we dressed differently, too. We wore derbies, stiff collars and shoes, and you could easily tell a male from a female." The graduating class' president gave a short talk discussing a letter from President Nixon.

After lunch, the Class drove to Chatham Bars Inn where they found it cooler. Everyone relaxed at cocktails and dinner. There was much visiting on the porch and in the lounges Friday, Saturday and Sunday. Some brave souls went swimming, some played golf while others went shopping or hiked around the area. Dean Webster, Ben Sherman and Ben Bristol played the Chatham Bars Inn course and Karl Rodgers, Winnie and Lloyd Sorenson and your secretary, Gene Smoley, played Eastward-Ho on Saturday.

At noon on Saturday there was a clambake on the shore, which was well attended and enjoyed. There was an abundance of steamed clams and broiled lobsters. The waitresses entertained with some songs after lunch.

On Saturday evening the Class had its banquet with President and Mrs. Howard Johnson as guests. Everyone had a chance to visit for a while and after the dinner President Johnson talked to the Class informally. Sunday morning was another good opportunity to get around and see everyone and lots of snapshots were taken. The Class drove to McCormack Hall after lunch on Sunday.

Alumni Day was Monday and this was a busy day for everyone. Osiris breakfast was attended by Marshall Balfour, Jimmy Reis, Gene Smoley and Don Way. Talks on various interesting subjects by the M.I.T. faculty were given in the M.I.T. buildings. Lecture tours and morning coffees were also well attended. Lunch was at Rockwell Cage; the luncheon speakers were President Johnson, Massachusetts' Governor Sargent, '39, and Puerto Rico's Governor, Luis A. Ferré, '24. After lunch the presentation of the 50-year, 40-year and 25-year gifts to the Institute were made. **Paul Sheeline,** our Fund Chairman, presented a gift of $660,000 as our 50-year token to the Institute. Special thanks go to Paul, and also Dean Webster and all those who contributed effort and wherewithal.

The afternoon program included a panel discussion and Apollo films. Cocktails in the gymnasium followed; dinner in the Cage and dancing concluded the day. Most left for home the next morning.

50th reunion attendees

For the records the following classmates attended reunion: Franklin S. Adams, Marshall C. Balfour, William H. Banks, Paul W. Blye, George R. Bond, Nelson A. Bond, Benjamin H. Bristol, Royden L. Burbank, George W. Cann, Horace W. Denison, Everett F. Doten, Edmund J. Flynn, Maurice E. Goodridge, Louis J. Grayson, Daniel C. Hall, Richard S. Holmgren, James Holt, Alfred W. Hough, Walter M. Howlett, Kuang Piao Hu, Frederick L. Hunter, S. Albert Kaufman, Leo A. Kelley, Arthur C. Kenison, Harry A. Kuljian, Wilfred O. Langille, Marshall B. Lee, Milton A. Loucks, George C. McCarten, Alan H. McIntosh, Robert B. MacMullin, George Michelson, Edward G. Moody, Russell S. Palmer, Ellsworth G. D. Paterson, Amos N. Prescott, James W. Reis, Philip L. Rhodes, Arkley S. Richards, John L. Riegel, Karl F. Rodgers, Edgar F. Seifert, Paul D. Sheeline, Benjamin H. Sherman, Leighton B. Smith, Eugene R. Smoley, Lloyd R. Sorenson, Frederick C. Spooner, John Stevens, Chester C. Stewart, Carl L. Svenson, Donald D. Way, Dean K. Webster, Francis A. Weiskittel, Horace D. White.

The widows of the Class were invited to attend our reunion and Mrs. George W. McCreery and Mrs. Joseph S. Newell were able to make it. Word came back from Mrs. George G. Fleming, Mrs. Stuart J. Hayes, Mrs. S. S. Kivan, Mrs. Scott Keith, Mrs. Albert P. Schafer, Mrs. H. Stanley Weymouth, Mrs. Richard B. Stehle, Mrs. Thomas L. Goodwin, Mrs. Gustave Levy, Mrs. Miriam E. deBogden (formerly Mrs. Robert F. Morrison), Mrs. Hyman E. Spector, Mrs. Alfred A. Johns, Mrs. Warren A. Maynard, Mrs. Ross H. Hysom, Mrs. G. F. Beers, Mrs. Jacob Lichter, Mrs. Lawrence M. Dalton, Mrs. Leo E. Beaulieu, Mrs. Paul F. Swasey, and Mrs. Robert C. Friedlich.

A letter from **Chuck Drew,** 5025 Yvonne Terrace, Minneapolis, Minn. 55436, expressed his regrets at not being able to attend the reunion. "Mrs. Drew is not well and I hesitate to leave her for any extended period." . . . **Arnold B. Staubach,** 2660 Marilee Lane, A 19, Houston, Texas 77027, was unable to come due to protracted illnesses. . . . **Franklin S. Adams,** 2606 Clark St., Paducah, Ky. 42001, attended the reunion, and visited two invalid relatives in the Boston area.

Illness prevented **Charlie M. Herrick** from coming. . . . **Harry A. Kuljian** was there with a smile all the way. He has changed his address to Hampton House, Apt. 4X, Hagy's Ford Hollow Road, Penn Valley, Narbeth, Pa. 19072. His letter after the reunion congratulated the committee and pronounced it a wonderful and successful reunion.

Jim Reis returned from his trip to Australia and New Guinea in time to make the reunion. His address—350 S. Fuller Avenue, Apt. 116, Los Angeles, Calif. 90036. . . . **Larry Riegel** also returned from an extended trip—to Africa—to attend the reunion. He has been made a Director of the Alumni Center of New York. . . . Captain **E. E. Saunders,** U.S.N. ret., 815 Town Mt. Rd., Asheville, N.C., was expected at the reunion but has written to say: ". . . events have now shaped up which make it unwise for us to attend. We are moving into a Navy, Marine Corps, Coast Guard Foundation apartment for retired people." . . . **Lloyd** (Sorry) **Sorenson** and Winnie have returned from a year's sojourn in Singapore where he served as technical advisor and ship building consultant to the Singapore government. He was sent there by I.E.S.C. as a volunteer executive without pay, but with all expenses paid.

Health prevented **Fred R. Hewes** and his wife from attending. . . . **H. S. Winkfield** was away so he could not come. . . . **Don Kitchin** was unable to make it because of heart trouble, angina and high blood pressure. . . . **L. A. Jackson** sent regrets because of ill health.

Ken Wright sent his regrets and says: "If any of you wander our way, come and see us." P.O. Box 808, Vicksburg, Miss. 39180. . . . **Walter F. Walworth** writes: "Due to poor health, I shall have to miss the big one." . . . **H. Peach** writes: "Sick, broke in Florida" and could not come.

Ralph H. Gilbert writes: "My wife is a stroke victim, and this keeps me pretty well tied down; I regret I will not be able to join you all at our 50th." . . . **Maurice E. Goodridge** came in a wheel chair due to arthritis and will need some surgical work in Robert Brigham Hospital, Boston, later. We all wish him the best and it was good to see him at reunion. His address is: 37 Old English Rd., Worcester, Mass. 01609.

Leon H. A. Weaver, 1221 Maryland Ave., Cape May, N.J. 08204, wrote his regrets due to his limitations and inability to travel any distance. He had a colostomy operation four years ago. He writes: "In 1917 I was registered for draft in W.W. I and my number was the second one nationally to be drawn from the fish barrel.

"I was married to Dorothy Alexander in the Little Church Around the Corner in New York, August 29, 1917, a week before induction. I was among the first sent to Camp Dix. Five months later I was sent to France where I served in a locomotive repair shop for the Transportation Corps in Nevers, France." Leon retired from Raymond Concrete Pile Company in 1958 and appears in *Who's Who in Engineering.* . . . **Ernst Voss** wrote to say he would not attend the reunion. He states: "When the Class graduated in the fall of 1918, I was aready hard at work in Akron, Ohio." Earnie had a career with Humble Oil Co., Houston, Texas.

Max Untersee wrote to say he couldn't make the 50th "I've toured back to my homeland for the past several summers to enjoy my sister's island in a New Hampshire pond and to visit with her and another sister who comes in from Pennsylvania. This year I regret to say that my anticipated reunion at M.I.T. and my sister's will both be without my company." He continues, "I am a consulting architect with the Space and Missile Systems Organization of the Air Force." . . . **Lawrence A. Gillett,** 7520 Hampton Blvd., Norfolk, Va. 23505, has had considerable illness and although intending to come was finally prevented.

Alan H. McIntosh, 424 Rolin Road, Waverly Ohio, 45690, came with his wife. She attended her reunion at Vassar preceding ours and they planned an extended trip through Canada and the coast states after the M.I.T. reunion. . . . **Louis Grayson** came to reunion with his sister-in-law, wife of his older brother, M.I.T. '16. . . . **Aubrey P. Ames,** 1980 Washington St., San Francisco, Calif. 94109, was unable to get here as the reunion came at a time when he was otherwise occupied. . . . **Morton A. Smith,** Great Barrington, Mass., was unable to come as he had to stay home to take care of his wife who is an invalid. He has been "chief cook and bottle washer" for six years now. His health is good and he still does some radio service work at home although he sold his business six years ago. He expected to meet **Franklin S. Adams** at Stockbridge about 9 miles away.—**Eugene R. Smoley,** Secretary, 30 School Lane, Scarsdale, N.Y. 10583

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Alumni Day was enriched by the presence of the following faithful and distinguished members of the oncoming fifty-year class. President Norrie and Betty Abbott, Perk and Mina Bugbee, Al and Betty Burke, Bill and Barbara Dewey, Bob and Laura Patterson, Ed and Beth Ryer, Frank Badger, Scott Carpenter and the Wason twins, Al and El. Scott Carpenter pointed with pride to the presence of Scott, Jr., who was attending his twenty-fifth class reunion. All expressed keen interest in the big reunion at Cambridge next June and are sure to be on hand along with the scores of classmates and wives that have already signified through communications to Chairman Ed Ryer their intention not to miss this great event. This is going to be a busy and exciting year for the Class, so do make an extra effort to keep us informed of your doings and whereabouts. We hereby promise to keep you closely in touch with the plans of the various committees right up to the last minute.

The International Executive Service Corps, sometimes called the businessmen's Peace Corps, features the yeoman service of one of its most prominent members, namely **Harry Kahn,** who has recently been actively engaged in contributing his vast knowledge and experience on ceramics to Fil-Hispano Ceramics, Inc., of the Philippines, manufacturer of glazed tiles. Harry and Hannah were out there for several months but are now back in Uxbridge, Mass., where Harry was plant superintendent of the Stylon Corporation.

About the time you are reading these notes, **Ray Reese** will be receiving Honorary Membership in the American Society of Civil Engineers at their annual meeting in Chicago. Ray, long a foremost structural engineer in Toledo, Ohio, has been a leader in the development of codes and standards for reinforced concrete structures. Ray is one of only seven of the Society's membership of 62,000 members to receive this high honor.

Among those who have been spending the summer close to the North Atlantic's cooling breezes are **Skeetz Brown** at West Harwich on the Cape, **Bob Bradley** at his old stamping ground, South Dartmouth, Mass., and **Perk Bugbee** at 5 Howes Lane, Plymouth, Mass. **Buzz Burroughs** reports a delightful cruise aboard Mich Bawden's, '21, yacht all the way up to Brooksville, Maine, where he had a pleasant reunion with Commodore **Jim Gibson** and Buck Clark, '21, whose summer homes are adjacent to Buck's Harbor.

Other addresses we have come across recently, though they may not be new, are: Captain Fred M. Earle, 392 Vinson Hall, 6251 Old Dominion Drive, McLean, Va.; Frederick Bocher, 3506 16th Ave., West Bradenton, Fla.; Larry Winant, Box 413, Millbrook, N.Y.; Professor Albion Doe, 333 Vincellette St., Bridgeport, Conn.; and Robert L. Burchell, RFD 2, Box 64, Yorkville, Ill.—**Harold Bugbee,** Secretary, 21 Everell Road, Winchester, Mass. 01890

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Welcome to you and yours, dear classmate, to start our 49th consecutive year of reporting the unfolding history of the Class of '21 for your enjoyment around the friendly fireside reserved for our active group. We hope you will participate in these live discussions by sending us news of your retirement activities, your family, travel, members of the Class whom you have seen—and top it off with a photograph suitable for use in these columns. Our goal is to present an article on everyone in the Class before our one and only 50th reunion, scheduled for June 10 through 14, 1971. Please volunteer your help by writing now—and tell us you and your wife plan to join the happy throng at the 50th!

Stone sphere mystery

Two national magazines have articles of particular interest. In the August, 1969, issue of the *National Geographic Magazine,* **Ernest R. Gordon,** who was graduated with us in Course XII, is credited with calling attention to giant stone spheres he found in Mexico, six to eight feet in diameter and resembling, as he thought, the huge pre-Columbian handmade globes previously found in Costa Rica. Ethnologist and archaeologist, Matthew W. Stirling tells, in "Solving the Mystery of Mexico's Great Stone Spheres," of his interest in the fascinating carved sphere artifacts left by early Americans. Ranging from inches to seven feet in diameter, they were sometimes placed in ritual formations. Ernie's discovery stemmed from his having once superintended a Mexican silver mine which had a single stone sphere at its entrance. Recently, he had prospected in the same area and had found groups of stone spheres. He and Mrs. Gordon accompanied Mr. and Mrs. Stirling and others on an exploratory trip, eventually locating not only the stones Ernie had seen but hundreds of others up to eleven feet in diameter. Subsequent study showed the spheres to have been made by nature through crystallization at high temperature in a matrix of hot ash some 40 million years ago. Ernie and Aurora make their retirement home at 143 Buena Vista Dr., Grand Junction, Colo. 81501. He still carries on consulting in the mining field and does some mineral exploration work. They have two married daughters, a married son, and seven grandchildren.

The Boston arm

Dr. Allen L. Cudworth, M.I.T. '52, and son of our **James R. Cudworth,** retired dean of the College of Engineering, University of Alabama, shares credit with M.I.T., Massachusetts General Hospital, Harvard Medical School, and the Liberty Mutual Insurance Co., of which Allen is director of research, in the development of a new type of prosthesis for above-elbow amputees. The *Boston Arm,* so-named for these four organizations who cooperated to develop it, is operated by the body's muscle electromyographic signals in contrast to earlier prostheses which required cable motions produced by unnatural body movements. An article in the February, 1969, issue of *Reader's Digest* tells of the work of the various laboratories and personnel involved. [*See also*: Technology Review *for December, 1968, p. 82.*] It concludes that it is possible to manufacture a fiber-glass casing, resembling an adult arm in shape and weight, containing all the necessary transistors and motor drive, which can be employed successfully by most over-elbow amputees with only a few minutes of training. A note from Jim Cudworth, 1 Hickory Hill, Tuscaloosa, Ala. 35401, says "Retirement from the deanship has meant increased consulting with the U.S. Bureau of Mines and more travel. Emily and I have recently returned from Portugal and Spain." The Cudworths have two married sons.

Alumni Homecoming '69 last June started Sunday evening with an informal '21 dinner at the Charter House in Cambridge, attended by Anne and Wally Adams, Maxine and Cac Clarke, Kay and Ed Delany, Maida and Ed Dubé,

Elma and John Mattson, Marty and Bill Ready, Eric Smith and Ted Steffian. The Adams and Mattson couples had just returned from a trip to Nova Scotia; Marty and Bill Ready made a special trip from Florida for the occasion as did Eric Smith from Montreal. The Monday events saw the '21 contingent swell to a total of 45 with the addition of Elizabeth and John Barriger 3d, Helen and Mich Bawden, George Chutter, Claudia and Josh Crosby, Eleanor and Fritz Ferdinand, Sara and Harry Goodman, Bob Haskel, Jack Healy, Jr., Jimmie Janes, Anne and Mel Jenney, Algot Johnson, Laurie and Chick Kurth, Emma and Al Lloyd, Helen and Bob Miller, Kay and Phil Nelles, Jr., Ace Rood, Paul Rutherford, Celia and Steve Seampos, and Anna and Frank Whelan.

That morning, a number of distinguished speakers presented problems in various fields which dealt with "human purpose" and bridged more than one discipline. The impressive service in the chapel memorialized all alumni deceased since the 1968 Homecoming and included the 17 from our Class whose passing has been noted in these columns. The traditional luncheon, with our own Howard W. Johnson, was followed by further presentations of the "human purpose" theme. The Class of '21 gathered again for cocktails and dinner. As usual, a good time was had by all in the many opportunities to meet with one another. Truly, our own close association and the burgeoning friendship of our wives have significantly marked M.I.T. contacts as the most satisfying and lasting ties of our entire lives.

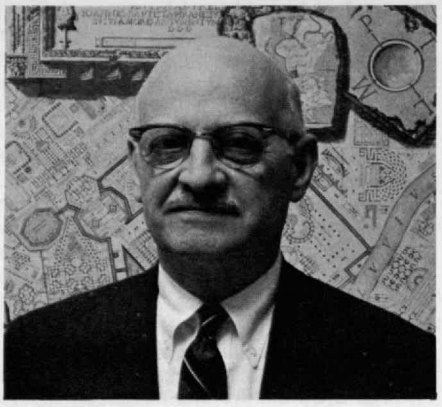
First class mail

Anne and **George Schnitzler,** 32 Gerry Rd., Chestnut Hill, Mass. 02167, report a trip west to the national parks and the Canadian Rockies. A card, picturing the Grand Tetons and postmarked at the "Old Faithful Station" in Yellowstone, says: "The first leg of our trip from Salt Lake City to Yellowstone has been completed. If the Canadian Rockies are anything like the magnificent Grand Tetons, a tremendous treat is in store for us. We arrived in Yellowstone just in time to witness 'Old Faithful' in action and to photograph it." . . . **Donald B. Carter,** 2174 Main St., Glastonbury, Conn. 06033, writes that he has retired but, since he didn't send us the class data sheet, we are unable to give details. . . . **Roy A. Wehe,** 51 El Cerrito Ave., San Mateo, Calif. 94402, says: "Grace and I had an enjoyable motor trip through the New England states in the summer of 1968. We were guests of our classmate, **George T. Welch** [Emeritus treasurer of Vassar College, Poughkeepsie, N.Y.—Cac] at his summer home on Lake Champlain and we visited M.I.T." Roy says he is still active in his own engineering practice in San Francisco, specializing in public utility management. The Wehes have a married daughter and two grandchildren. . . . **Frederick F. Olson,** R.F.D., Ossipee, N.H. 03864, retired in 1962 as manager of industrial engineering and machine development with B. F. Goodrich Co., Watertown, Mass. He adds: "Am busy restoring a 200-year-old colonial house, gardening and fishing. We have traveled in the U.S. and have spent the last four winters in Mexico, taking handicraft courses at *Instituto Allende,* the Mexican art institute in San Miguel." Ruth and Fred have two sons and two daughters and four grandchildren. This winter we hope that Fred will look up Colonel **John M. Johnson** of our Class and Mrs. Johnson, who make their permanent retirement home in San Miguel.

Harry M. Ramsay, 10830 Venturi Dr., Sun City, Ariz. 85351, pens a cheerful note: "No news but living a full and happy life in these last eight years of retirement in the growing Southwest." Harry formerly owned and operated a wholesale tire and battery distributing firm in Minneapolis. He and Agnes have two married sons and a married daughter and ten grandchildren. . . . **Victor S. Phaneuf,** associate professor of building construction, University of Florida, retired colonel, Corps of Engineers, U.S. Army, and former construction engineer, tells of his mandatory retirement by the university last June. He and Muriel have sold their home and moved into Camelot Apt. 155, 3425 S.W. 2nd Ave., Gainesville, Fla. 32601. Says Vic: "I will keep myself busy selling mutual funds—a third career—and would be glad to hear from anyone interested in investing companies." The Phaneufs have a married son in Rockville, Conn., and four grandchildren. . . . Since his retirement as chief of the engineering and development laboratory for food process development with the Eastern Research and Development division of the U.S. Department of Agriculture, **Roderick K. Eskew** has undertaken an extensive safari to Africa and an exploratory trip into the Kissimmee wilderness of central Florida. His wife, Melina, accompanied him on both journeys. The Eskews have long been summer residents at their cottage on Gulf Dr., Sanibel, Fla., and are planning a permanent home there in the Palm Lake area. They now live at "Roseburn," Box 205, Spring House, Pa. 19477. Rod is still active as a consultant to government and industry on food processing.

Clippings continue to pour in with the account of the lifetime honor bestowed upon our Assistant Secretary, **Ted Steffian,** in being selected a member of the College of Fellows of the American Institute of Architects in recognition of his 37 years of outstanding contributions to the profession.

Through the courtesy of Norman Joy Greene, '22, of Newtown Square, Pa., governor general of the General Society of Mayflower Descendants, we have an article from the August, 1969, issue of *Philadelphia Magazine* on the activities of owners of larger pleasure boats who make use of the facilities of the Great Oak Yacht Club, Chesapeake Bay. Norman pointed out the reference to the



Edwin T. Steffian, '21

luxurious 63-foot aluminum-hulled Burger owned by his brother Beta, **J. Trevor Peirce** of our Class. The Peirces derive much enjoyment from continual use of their comfortable craft, which they take to Florida each fall under guidance of a captain to sail and maintain it. We wrote to Trev, who is vice president of Peirce-Phelps, Inc., 2000 Block North 59th St., Philadelphia, Pa. 19131, and who has replied, in part: "I thought the whole story was in very bad taste and certainly did not portray the real charm of the Chesapeake or the way most boaters enjoy it. I don't know that there is much of interest I can give you. As you know, my brother, W. G. Peirce, Jr., '24, and Charles Phelps, '24, founded our company 43 years ago and my brother and I are still active. Charlie Phelps died 12 years ago. I have always loved the water and have been quite a serious boatman for the past 22 years. I have four children, three boys and a girl, and ten grandchildren. I haven't cruised to New Jersey this summer but if I get into Brielle next year I shall make it a point to give you a call. If you're in Philadelphia be sure to let me know and we'll have lunch together." Thanks, Trev; it has been a long time since we've seen each other and we're looking forward to correcting that situation soon.

The Campbells are here

Professor **Roy J. Campbell,** Star Route 2, Bath, Maine 04530, has written to the Alumni Office requesting that his affiliation with the Class of '21 be restored. We are most happy to welcome Roy back to the fold. Pending receipt of current data from him, we recall he was professor of biology at Salem College, Winston-Salem, N.C., and assume he has retired to his native state of Maine. In one of those curious coincidences that happen so often, the correspondence with Roy was closely followed by a letter from **Elmer W. Campbell,** Box 3, Lovell, Maine 04051. Both these classmates have master's degrees in public health from Course VII at M.I.T.; Roy is a native of Sabattus and Elmer of Ashland, Maine; Roy has a bachelor's degree from Bates and Elmer one from Colby, and both seem to be enjoying retirement after many years in their chosen fields. Nothing in our records indicates that they are related and we shall endeavor to find out! Writing from

Lovell, Elmer, the former director of the division of sanitary engineering of the Maine State Department of Health and Welfare, says a serious case of flu prevented Becky and him from joining the '21 interim reunion in Mexico last March and they remained at their Seminole, Fla., winter home. There they had a visit from Ruby and the late William F. Lawrence, also Course VII, who died shortly afterwards on April 15, as reported in these columns. Elmer adds that Theona and **Albert S. Genaske** are at their cottage on Lake Kezar, Lovell, Maine, for the summer, following their return from a trip to Guatemala and Mexico earlier in the year. The Campbells will leave Lovell for Seminole in November.

A number of new retirement home addresses have been received, including: Philip A. Willis, 118 Rosewood Dr., Metairie, La. 70005; Lemuel Pope, Apt. 401, 1469 Bellevue, Burlingame, Calif. 94010; Vice Admiral Homer N. Wallin, Apt. 506, 4545 Sand Point Way, N.E., Seattle, Wash. 98105; Alfred J. Shaughnessy, Rt. No. 2, Deerbrook, Wis. 54424; Whitney H. Wetherell, Apt. 2, 108 Robert Dr., Syracuse, N.Y. 13210; T. Dillwyn Dutton, 3379 Sheffield Cir., Sarasota, Fla. 33580; Colonel Robert A. Hill, 8101 S.W. 72nd Ave., S. Miami, Fla. 33143; Richard J. Spitz, Vineyard Haven, Mass. 02568, and Morris B. Hart, Apt. 11, 239 Lexington Blvd., Clark N.J. 07066. . . . In the photo caption in the July *Review,* showing the group at a picnic of the M.I.T. Club of Southwest Florida, Albert E. Smith and John B. Starkweather should both have been designated as '22. Also, the names listed for the pictured group from the Class of '21 in Mexico should have been given in reverse order.

Leonard R. Janes, 2520 Noyes St., Evanston, Ill. 60201, phoned us from New York on his way to Homecoming at M.I.T. Jimmie was visiting his daughter and planned to drop in on Anne and **Mel Jenney** while in Cambridge. We regret to learn that Mrs. Janes passed away in 1963. Jimmie, who retired from Commonwealth Edison's planning and development department in 1961, says he has fully recovered from his one-year stint as professor of physics at McKendree College, Lebanon, Ill. Following attendance at Homecoming, the Jenneys made a European tour. . . . A card from Berne, Switzerland, postmarked in Zermatt, was received from Laurie and **Henry R. Kurth,** who live at 330 Beacon St., Boston, Mass. 02116. Chick writes: "The capital city of Switzerland is delightfully clean and people are friendly. Hardly any long hairs on display. Ideal weather has made our trip most enjoyable." . . . From the Manasquan (N.J.) *Coast Star* of August 14, 1969:

"Alfred H. Fletcher, who was director of the Division of Environmental Health, New Jersey State Department of Health, since July, 1949, retired from service on July 31." Elizabeth and **Al Fletcher** make their home at 22 East Welling Ave., Pennington, N.J. 08534. They have a married and a single son and two granddaughters.

Well-deserved honors have been showered upon the staff of *Technology Review* in the form of an award from the American Alumni Council naming *our* alumni magazine in the first ten among all those in the country, for its general excellence. Salaam! Not to be outdone, the Amity Fund has been awarded first place by the Council in competition with all major *private* universities, for its sustained high level of alumni gifts and participation—and third place in the same competition with *all* universities. Thus, as a result of *your* loyalty and generosity, dear reader, M.I.T. receives an additional unrestricted grant of $2,000, a trophy, and a certificate. Heartiest thanks go to our team of **Ed Farrand, Ed Dubé** and **Irv Jakobson** for their tireless efforts in bringing '21 to sixth position, among all 68 individual class units reporting, with the year's splendid gift to the Amity Fund of $103,387. . . . Other vital news from Cambridge includes the $15 million project to build the largest structure since M.I.T. moved from Boston, the 250,000-square-foot Electrical Engineering and Electronics Complex to house the Institute's largest department and the Research Laboratory for Electronics. Something over $5 million still remains to be funded to enable the start of construction.

In Memoriam

We sorrowfully regret to report the passing of three classmates and we extend to their dear ones the sincere sympathy of the entire Class of '21. . . . **George Sisson Safford,** 14 Bancroft Rd., Wellesley Hills, Mass. 02181, died in February, 1968. Born on September 6, 1899, in Glens Falls, N.Y., George had attended Clarkson College of Technology and joined us in the sophomore year. At M.I.T., he was a member of the Chemical Society and a private in the S.A.T.C. during World War I. He was graduated with the bachelor's degree in Course X. Over the years, he had been active in New England sales managerships for the A. Sherman Lumber Co. of New York and the Massachusetts Wharf Coal Co., Boston, retiring in 1955. . . . **Kenneth Mason Moore,** 2810 Woolsey St., Berkeley, Calif., 94705, died on April 30, 1969. He was a retired colonel, Corps of Engineers, U.S. Army. A graduate of the U.S. Military Academy, he joined us in the senior year and was graduated with a bachelor's degree in Course I. Following service at Fort Humphreys, Va., he was promoted to captain and assigned to the Missouri School of Mines as professor of Military Science and Tactics. He served in the Pacific Theater in World War II and was retired as a colonel in 1955.

Lawrence Baxter Richardson, 1885 Fountainhead Rd., Hagerstown, Md. 21740, died on July 6, 1969. He was a retired rear admiral, U.S. Navy. Born in Swampscott, Mass., on January 13, 1897, he prepared at Methuen (Mass.) High School and was graduated cum laude from the U.S. Naval Academy in 1917. Following service in World War I, he joined us in the senior year and was graduated with the master's degree in Course XIII-A. From 1917 through 1946, he served the U.S. Navy in all ranks from ensign to rear admiral. Originally in the Construction Corps in various Naval Air Stations, he concluded active service in the Navy's Bureau of Aeronautics, Washington. His decorations included the Legion of Merit and Commander, Order of the British Empire. In civilian life, he became vice president of Curtiss Wright Corp., New York, in 1946. Two years later, he became president and director of research and engineering of Fairchild Engine and Airplane Co. From 1951 to his retirement in 1962, he was the senior vice president in charge of engineering for General Dynamics Corp. He had been president of the then Institute of the Aeronautical Sciences in 1951 and was a member of the Society of Naval Architects and Marine Engineers, the American Nuclear Society and the American Helicopter Society. Other memberships included the River and University Clubs, New York, and the National Press and Army and Navy Clubs, Washington. Surviving are his wife, the former Thelma Newcomer of Cleveland; three sons, Captain William C. Richardson, U.S.N.A. '42; Lawrence B. Richardson, Jr., U.S.N.A. '44, and Philip W. Richardson, Princeton '55; a brother, three sisters and several grandchildren.

Next month we will cover the Class of '21's participation in the Alumni Officers' Conference and the Alumni Seminar, both at M.I.T. in September. Important among the dates for you and your wife to reserve are Homecoming 1970 next June 14-15, and our once-in-a-lifetime 50th reunion on June 10 through 14, 1971. Have an even happier Thanksgiving with the satisfaction of having sent to one of your secretaries that letter you've long promised yourself you would write.— **Carole A. Clarke,** Secretary, 608 Union Lane, Brielle, N.J. 08730; **Edwin T. Steffian,** Assistant Secretary, Steffian, Steffian and Bradley, Inc., 19 Temple Place, Boston, Mass. 02111; **Sumner Hayward,** Assistant Secretary, 224 Richards Road, Ridgewood, N.J. 07450

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Greetings from your class officers for the 1969-1970 season! Our last notes were written in May after which we heard from classmates directly during Alumni weekend of June 15-16. The usual cocktail party in Dover given by Parke and Madeline Appel was enjoyed by Yard and Ruth Chittick, Buck and Mrs. Eacker, Ab Johnson and his guest, Oscar and Mary Horovitz, the Ted Millers, Tommy Thomson and Bob Tonon. On Alumni Day our group also included Warren Ferguson, Whit Ferguson, Dewey Godard, Bill Hyland, Sam Reynolds, Roscoe Sherbrooke, Hugh Shirey, Ken Sutherland, Karl Wildes, Fearing Pratt, Bill Elmer, Bill Riley, Florence Stiles, Julian Lovejoy, Professor John Wulff and Irving Abrams.

We enjoyed the morning lectures and visits to various sections of the Institute. The luncheon was given in Rockwell Cage to avoid the possibility of the tent blowing down and the inconvenience of rain.

Tommy Thomson told us of having dinner with Hardy and **Jack Liecty** on Hardy's birthday with hopes of again seeing them during the summer. He said that **Dale Spoor** had expressed his disappointment in not being able to be with us—and we missed Dale! . . . A July letter from **Parke Appel** will bring you up to date on several items: "Since this is a long overdue report of information that may be useful for your notes I will go back to March when Madeline and I took off for Mexico and the 21st M.I.T. Club of Mexico City Fiesta. We left Boston with the temperature zero after the third blizzard with a cumulative snowfall of seven feet on the ground. I realize that such things are unheard of in 'Beautiful Warm, Sunny Buffalo.' However, after a two-day stopover in New Orleans we landed in Merida on the Yucatan Peninsula in Mexico around six p.m. with the temperature exactly 100°. We were met by a wonderful classmate of ours, **Arturo Ponce G. Canton,** at the Merida Airport. He is certainly Mr. Merida or better Mr. Yucatan. He had already arranged an exciting schedule for us to follow in seeing the beauty of that country. We enjoyed the hospitality of his home, met his fine family of two sons and a daughter with his grandchildren. We stayed at the Hotel Merida which he was instrumental in having built a few years ago, attended a Mexican wedding and reception, and he personally escorted us to Uxmal to see the pyramids and castles of the Mayas and Toltecs that were built some 1,200 years ago. We were further fascinated by a visit to Chicen Itza where we saw very elaborate ruins bearing evidence of a very sophisticated and knowledgeable civilization. We shall definitely revisit Yucatan someday.

" 'Ponce' joined us in a flight from Merida to Mexico City arriving at 3:30 a.m. After catching up on our sleep we joined Jack and Hardy Liecty at the Hotel Geneve the day before the start of the Fiesta. After taking in some of the sights and exceptional eating places we went to the Museum of Anthropology which is superior to anything in its class in the world. That night we went to the Folklorico at the Palacia De Belles Artes where the Liectys and we were overwhelmed by the attendance of M.I.T. friends in great numbers.

"The following day the Fiesta began. The Classes of 1921, 1922 and 1923 were celebrating interim reunions and those in attendance from 1922 included Charles Moore, Elmer and Elizabeth Sanborn, Jack and Hardy Liecty, Parke and Madeline Appel, Irving and Mrs. Loss, Reed and Mrs. Dallye. The Fiesta was a tremendous success in every way and I urge those who have not attended one to be sure and take one in for a most enjoyable time. We were also royally entertained at "Nish" Cornish's '24, home on the Sunday following Fiesta. The next day Madeline and I enjoyed the hospitality of Conchita Lobdell Pearson at her home for lunch after which she kindly drove us to the airport where we took off for Acapulco where we spent the rest of the week at the Club De Pesco basking in the sun with superb weather.

"Following Acapulco we flew to Tampa and spent two most enjoyable days with Berdie and Ed Schmitz, '23, very good friends dating back to Tech Show days. Ed has just retired and purchased a beautiful home in Belleair, part of Clearwater. We hired ourselves a Pontiac Firebird and spent a week running around Florida on both the east and west coasts, but in the southern part. During our week here we saw Mitch Bawden, '21, Ed Ryer, '20, several other couples not identified with Tech and we just missed Yard Chittick by a matter of 10 minutes. On the East Coast we enjoyed the hospitality of Carlys and **Frank Kurtz** at their lovely home in Delray. We also saw their next door neighbors in their lovely home—**Ted** and Mrs. **Riegel.** On April 1 we flew back to good old Dover, after one of our most pleasurable trips.

"Since I last saw you I have sounded out several members of our Class concerning the establishment of a Memorial Window at Tech. It would be most unusual and perhaps the only one for a considerable number of years to come. In fact I find there is an increasing ground swell of interest in this proposal which is to raise the necessary funds to provide a suitable stained glass window to memorialize the window through which Dorothy was surreptitiously smuggled (at night against all Institute rules) into the dynamo lab where our hero experimented into the dawn. The story behind this is somewhat akin to Peter Abelard and Heloise and is deserving of a memorial. Especially so since in all great love stories in history it was the male who climbed through the window. This is what makes this incident so unique.

"And you, you rascal—you wouldn't tell me about your honors, I had to wait until your secretary would tell us about Mr. Buffalo and your highly deserved kudoes in the class notes composed in your absence while you played footsie with the Ruskies. Seriously I hope you will find some measure of grist in this dribble to be newsworthy to you. Have a grand summer on Lake Erie. I look forward to seeing you at the Alumni Officers' Conference September 5 and 6. Our very best personal greetings to Dorothy."

Construction-Man-Of-the-Year

A very complimentary item and a good picture of **Horace W. McCurdy** was published in the *Daily Journal of Commerce* in June naming him their "Construction-Man-Of-The-Year." Horace becomes the ninth construction industry leader so honored for his achievement in public service, service to industry, public relations and in the science of design. He is director emeritus of the Pacific National Bank, Seattle, a director of the Lockheed Aircraft Corp., of Burbank, Calif., and has received many previous honors such as Maritime Man-of-the-Year, Civil Engineer of the Year, and First Citizen Award. Congratulations go to Horace for his continued constructive efforts in many fields.

We have reported to the Alumni Association the re-election of class officers including **Parke D. Appel** as President and Reunion Chairman and **Donald F. Carpenter** as senior Vice President and Estate and Reunion Gift Chairman. Don has started his campaign toward our 50th in 1972 and will be in touch with all of us more frequently from now on.

Thanks go to **Abbott L. Johnson** of Muncie, for a good letter and discussion of Alumni Day. Here are excerpts: "It was an interesting day yet quite disheartening to hear the illogical and flamboyant statement made by the so-called students. We discovered at Kresge that there were only about fifteen or twenty real M.I.T. students in the group, more than half of them being from other schools. It wasn't too pleasing to hear the physics professor from M.I.T. speak and also to see him join in the trouping of the group when they finally decided to leave the stage. Of course, these people feel very strongly that they are right, I am sure, but it is obvious that they are more given to wrecking the free enterprise system and installing communism than anything else. Of course, some of the youngsters appear to be dupes in this matter, but I am of the belief that some of them are also trained leaders.

"Just heard a minute ago that due to some last minute cancellations I am confirmed on the *Gripsholm* for the North Cape Cruise this July and August. It appears that my eleven-year-old granddaughter will be going with me and this should be a great treat for me. Last year she and I spent a week in San Francisco, then down to Disneyland for a week, then over to the HemisFair for a week and we had a delightful and interesting time. There was a lot of walking for me, but I came out of it with no particular increase in discomfort. So, I think this cruise is going to be a little easier than last year's trip. We plan on getting to Leningrad and Moscow as well as all Scandinavian countries and most of the principal ports. At the moment, I am very excited at the prospect."

We have received the program and order of service memorializing the deceased alumni of the past year held in the M.I.T. Chapel during Alumni Day. We extend our sympathy to the families of the twenty of our class members included therein. A most welcome letter regarding this service was received from Mrs. Paul William George of Concord, New Hampshire.

We were thrilled to see a picture of **Buck Eacker** in *Business Week* among the Beacon Hill residents who are concerned over the hippie invasion. We also report that **Frank O. Ricker** is enjoying snorkel-

ing and underwater picture-taking both at his home on Jupiter Inlet, Fla., and wherever else he can find clear water. **Lachlan MacKenzie** is now retired and lives in southern California. He reports travelling occasionally and extensively with the last trip extending over a year visiting Australia, New Zealand, England and Scotland. Professor **Edmund A. Ayres** has retired as Professor of Electrical Engineering at Ohio State University at Columbus. We also have a notice of retirement from **Randall W. Meech** in the Los Angeles area.

A correction is made herewith for reporting the address of **Raymond E. Miskelly** which should be Yarmouth Port, Mass., instead of Maine. His full address is 32 Camelot Road, Whalingport, Yarmouth Port, Mass. 02675.

Among the changes of address listed are those of: Dr. James L. Guardo, Chebeague Island, Maine; H. Ross Wiggs, Westmount 215, Quebec, Canada; H. Richard Allen, San Francisco, Calif.; Lee D. Warrender, Babylon, N.Y.; Donald F. Bixler, Berwyn, Pa.; Roland L. Smith, Charleston, S.C.; William J. Edmonds, Bainbridge Island, Wash.; Percy B. Bass, Tequesta, Fla.; Charles T. Harding, Orlando, Fla.; C. William Perkins, Ft. Lauderdale, Fla.; Norman J. Greene, Newton Sq., Pa.; Willard B. Purinton, Augusta, Maine.

We have received added notices of deceased members and send the sympathy of our class to the families of: Jacob Teich, Hackensack, N.J.; Thomas S. Craig, Elmira, N.Y.; Albert E. Page, Concord, N.H.; Dr. Edwin D. Martin, Hot Springs, Okla.; James Nesmith 2nd, Garden City, N.Y.; James R. Norton, Chicago, Ill.; Leonard P. Botting, Westwood, N.J.; James H. Allen, Merion Station, Pa.

Your future notes will include reviews of Parke Appel's travels to the Adriatic this fall and those of your Secretary and Dorothy who will spend most of September in England and Scotland. Don't miss these astounding adventures and please write us a few of your own. Hopefully yours—**Whitworth Ferguson,** Secretary, 333 Ellicott St., Buffalo, N.Y. 14203; **Oscar Horovitz,** Assistant Secretary, 45 Gerard St., Boston, Mass. 02119

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For this issue we have a few personally written news items which we feel make the most interesting reading. The first is from **Norman Weiss,** who writes, "We were fortunate in having a visit from Leon Task (1925) and Mrs. Task in late winter. Mary and I have found my consulting work (since retirement from ASARCO in 1967) a rare opportunity to travel here and abroad and work with some of my Course III-mates in distant places. In September and October we went to South Africa on a job where we encountered Tony and Nancy Gaudin (Professor Emeritus Course III). We spent a few days in Jerusalem, France, Greece, Italy and Portugal en route. Two months ago I was retained as metallurgical consultant by Conzinc Riotinto of Australia (Bougainville Copper Proprietary) to pass on the feasibility of this tremendous project on Bougainville in the Solomon group. This job took me to the site for two weeks, a most fascinating, though wet, experience, then back to Sydney, Melbourne, Adelaide and Broken Hill. We had an interesting return trip by way of New Zealand and Tahiti. Mary could not accompany me because of the primitive conditions on Bougainville. This will be the largest copper mining and milling operation in the world and it is exciting and challenging to be part of it. If this work permits, we shall visit South Africa again this fall. The Society of Mining Engineers . . . has given me the job of Chairman of a committee to put together a new handbook of mineral processing in the next five years, so if I have any time left over, it seems it will be used. . . . We were depressed to hear of Harold Pearson's death and we have written Conchita whom we had expected to visit this spring." Great work, Norman, we are delighted to get such interesting copy for these notes!

From **William** (Bill) **Wolfe** we have a note, "I have retired and moved to a condominium in North Miami Beach, Fla. However, summers, my wife and I still go caravanning about the country in our mobile trailer home. Last summer we visited the N.E. and before that the N.W. where we spent an enjoyable couple of days with Norman Weiss at his Tucson, Arizona home. Regards to all the members of 1932."

Lowell L. Holmes writes to me! "Unaccustomed as I am . . . to appearing in the Class of '23 notes, (I being one of those 're-treads' who joined up in the third year, 1921 and by age and temperament did belong to the Class of 1916) I now answer your call for something to print. While I retired from my business at Indianapolis, Ind., Management Research, Inc. as of January 1959 after spending a year in Mexico and two years in Charlottesville, Va., I finally arrived in Sarasota, Fla., in November of 1962. The next year our M.I.T. Club of Southwest Florida was formed and I served the first two years as President and since then have been Secretary-Treasurer. There are several of our Class in this territory and at our Annual Spring Picnic . . . Ray Holden, Dave Joy and Lowell Holmes were in attendance. On arrival here . . . Ray Holden became a director for our club and has been elected to serve as President for the next two years. I am informed that Ray and Grace will be in Massachusetts this month for a spot of grandchild watching while the daughter and husband do some continent hopping. If you run out of printable notes I'll give you some later on 'fun fishing' as only an amateur with just ten years of experience can possibly set forth; just how to fish freely and never burden the refrigerator or get a humpback from carrying home the fish. An accomplishment, eh what?" Very interesting, Lowell! Please sock it to us some more soon. These personal communications are the stuff we need. Please, classmates stop being so modest about telling us about your accomplishments whether it be career stuff, business or just plain fun!

Percival S. Rice tells us: "Retired June 1967. Am moving to South Yarmouth, Mass., on the Cape as of May 6, 1969." Also we see that **D. G. Brinton Thompson** retired in June of 1968 from Trinity College as Northam Professor of History, Emeritus. Our good friend **Julius A. Stratton** continues to add to his great accomplishments. In an *Ocean Industry* clipping we see further mention of his chairmanship of the Federal Commission on Marine Science, Engineering and Resources *(see Technology Review for April, 1969 p. 143)*. We quote, "those close to the commission's work were of the opinion that he did a remarkable job in working with the other members, all with different backgrounds. 'He has a knack for bringing about a meeting of minds,' a staff member commented." More about Julius—we see that he was re-elected to the board of directors of the Standard Oil Co. of New Jersey where he has served as Vice-Chairman of the Salary, Bonus and Stock Option Committee. Finally, in the February 1969 issue of the *The Physics Teacher* we see a review by H. Bentley Goss of Julius' book *Science and the Educated Man* (M.I.T. Press Cambridge, Mass. 1966). All of these will make most interesting reading.

John E. Burchard, Dean Emeritus of the Institute, received the University of Virginia's Thomas Jefferson Memorial Foundation medal in architecture during the April 14th Founder's Day ceremonies at the latter institution. John, who is widely known as a world consultant on architecture and urban affairs, is the second person to be named both this medal winner and Thomas Jefferson Memorial Professor of Architecture at the University of Virginia where he now serves.

One more news clip tells us that **Anton W. Hosig** and **Ernest W. Thiele** were both honored by the American Chemical Society as completing 50 years of membership in that society.

We now have particulars concerning the death of **Shepard Weinbaum,** who passed away on February 1, this year. From his widow, Mrs. Lillian Weinbaum, we learn that Shepard was quite well up to his last illness. He was comptroller of the E. Van Noorden Co. for 28 years. Besides his widow, Lillian, he left two sons, Bennett M. and Burton J. Weinbaum, and four grandchildren. He was past president of the Beth-El Hebrew School and a member of Zerrubbabel Lodge, A. F. & A. M. Lillian and Shepard had been married 44 years.

We are equally sorry to hear of the death of **Joseph Fleischer** on June 10 of this

Puerto Rico's Governor Luis A. Ferré, '24 (right), chats with Provost Jerome B. Wiesner at Alumni Day festivities.

year. Joseph was founder and president of Certified Pest Control Co. of Needham, Mass. He wrote Herb Hayden on May 1st. I feel obliged to quote from Joseph's letter to Herb since he seemed to be so happy. "Things in Florida are great. Not difficult to get used to. Play a little golf, gin and pinochle, walk a couple of miles each day, read a little, go to shows and socialize with new friends. It is amazing how time passes under these circumstances. Couldn't stand the extreme cold of the Massachusetts area at my age (68). . . . Trust that you and yours are in the best of health. . . . Fondest regards to all our classmates you run across." He leaves his wife Bessie (Weintraub) Fleischer, two sons, two brothers, a sister and six grandchildren. I hope to hear from Mrs. Fleischer soon and will let you know further.

We have just received a report of the death of Professor **Charles S. Keevil** of Needham, Mass., on July 19 of this year. Professor Keevil graduated with our class and received his doctorate in chemical engineering from the Institute in 1930. For the past nine years he was Professor of Chemical Engineering at Northeastern University and prior to that served as chairman of the Department of Chemical Engineering at both Oregon State College and Bucknell University.

During the war years he represented the National Defense Research Council at Edgewood Arsenal and later served as a senior staff member with Arthur D. Little, Inc. Charles was a member of numerous professional societies including, the American Chemical Society, American Institute of Chemical Engineers and the American Association of University Professors. He also held membership in Sigma Xi, Phi Lambda Epsilon, Phi Kappa Phi, Omega Chi Epsilon and Theta Delta Chi. He is survived by his widow Etta Pence Keevil, a sister and seven grandchildren. His first wife Charlotte West Thropp passed away in 1937. Two other deaths have also reached our attention: those of **Francis A. Rood,** February 11, 1963, and **Edward G. Pierce,** February 11, 1969.

Now, to violate the usual order of presentation of these notes, we can report the good news that **Art Davenport** has volunteered to help write the class history of M.I.T. 1923! He will need much help, so will all you good and true classmates who are willing to help please write him at 109 Bay Dr., Linkhorn Park, Virginia Beach, Va., 23451. Finally, before getting to the routine changes of address, the **Thomas Rounds** are now settling into their new home in Danbury, Conn. After a 25-year stay in a four bedroom house with attic we have moved into a two bedroom house with no attic. We finally made it after a good 7 weeks of intensive sorting out, selling and discarding the accumulation of 38 years of married life plus much additional stuff from our two families. The new house is great—see new address below. Apparently a goodly percentage of the great Class of 1923 are moving. Following is a list of our peripatetic members: Colonel Frank J. Atwood, 3361 S. Leisure World Blvd., Rossmoor, Silver Spring, Md. 20906; Herbert C. Button, Apt. 11-F, 850 Vine St., Liverpool, N.Y. 13088; Walter Dietz, R.D.#1, Pennsburg, Pa., 18073; Roland W. Frieder, Fulton Green Corp., 9 Washington, Chicago, Ill. 60602; Rear Admiral Lucien M. Grant, 4842 Kenmore Ave., Alexandria, Va. 22304; Alberto Lobo-Guerrero, Calle 95, No. 10-51 Bogota, Colombia; Dr. Joseph L. Hetzel, Breakneck Hill, Middlebury, Conn. 06762; Hyman F. Marshall, 12 Highfield Rd., Quincy, Mass. 02169; Stephen B. Metcalf, 230 Neck Rd., Madison, Conn. 06443; John H. Neher, The Nassau Club, 6 Mercer St., Princeton, N.J. 08540; Percival S. Rice, 26 Pebble Beach Way, South Yarmouth, Mass. 02664; Colonel Robert Sears, 2175 Wallace Rd., S.W., Atlanta, Ga. 30331; Erwin G. Schoeffel, 148 Wilson Hill, Massena, N.Y. 13662; Howard V. Shipley, Canadian Ice Machine Co., 65 Villiers St., Toronto, Ontario, Canada; Royal Sterling, Cinder Products Corp., 399 Kilvert St., Warwick, R.I. 02886; David Kaufman, 125 Cole Ave., Providence, R.I. 02906; Fernando de la Macorra, Paseo de la Reforma No. 2546, Mexico 10, D.F., Mexico; Anna A. Mohring, Apt. 3J, 3505 Parsons Blvd., Flushing, N.Y. 11354; Ping Y. Tang, 1002 Bank of Canton Bldg., Des Voeux Rd. C., Hong Kong, Hong Kong; Elwood A. Windham, 20 Helen St., Fanwood, N.J. 07023.

Don't forget to write Art Davenport if you can help in any way with the writing of the great history of the great Class of 1923!—**Thomas E. Rounds,** Secretary-Treasurer, 4 Deer Hill Dr., Danbury, Conn. 06810

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Spread around through these pages are reports of a number of reunions, a dozen of them quinquennials and a few more, interims. The locations vary all the way from Bermuda to northern New Hampshire, the participants vary all the way from first-timers in their twenties to octogenarians, but each report reaches the same conclusion: "Had a wonderful time—you should have been there." There's one other thing these reunions had in common: all included wives. Now that this has become the norm it hardly seems possible that for long years stag reunions were the accepted thing. Less than a decade ago the last holdout class gave in grudgingly. Our own first family affair was our 30th, and we have never regretted making the change. Ah, those wasted years.

Well, as predicted, our 45th was great. Bald Peak Colony Club at the top of Lake Winnipesaukee was an excellent choice. Food, accommodations, drinks, all were excellent. The location couldn't have been more beautiful, with distant views of Lake and mountains and close-ups of immaculate gardens and grounds. The weather was a bit on the hot side,

but that merely meant less time spent in athletic endeavors with the consequent dispersal of people, and more time spent on wide, shady verandas catching up on one another's changing fortunes. Dyed-in-the-wool golfers tried the links, of course (very sporting), and acquired instant ruddy complexions, a covey of early birds took before-breakfast dips in the lake (very trepid), but the bowling green saw little action, the tennis courts none, and in spite of the lure of landlocked salmon, no one went fishing. Our hot sporting blood was kept well in check.

Some of the early arrivals had to cool their heels for a bit, waiting for a group that preceded us to take its leave. They did so reluctantly. **Ed Moll** and **Nip Marsh** had rounded up a considerable amount of loot, everything from two days at Sturbridge Village to an ancient snuff box (empty), a driftwood mobile, and a pair of **Frank Shaw's** patented fire tongs for hot logs. After dinner Friday there was a grand drawing, and almost everyone went away with something. A lot of attics are a bit clearer as a consequence—and a lot of others are that much more cluttered.

Saturday was hot again. The golf, putting, and bridge tournaments went off as scheduled, but athletes and sitters alike responded with alacrity to the cocktail call. It was a lengthy "hour," as we milled around a sumptuous outdoor table of canapes, shrimp, stuffed mushrooms, and countless other delectable tidbits. **Kay Atherton** joined us there and spent the evening. It was wonderful to have her back with us again. **Griff Crafts,** a vision in white and waxed moustache, was M.C. at the banquet. **Paul Cardinal,** retiring president, sang his swan song; we stood for a moment of silence for those who had died since we last met; Corporation member **Ed Hanley** detailed the Institute's handling of campus unrest (we gave President Howard Johnson a unanimous vote of confidence); and **Clint Conway** and Paul, who for some unexplained reason thought it best to hide behind beards, presented the report of the Nominating Committee, also accepted unanimously.

So your officers for the next five years are: President, **Ed Moll;** Vice President, **Griff Crafts;** Treasurer, **Ray Lehrer;** Secretary, **Chick Kane;** and a whole raft of Regional Vice presidents, from Eastern to International; **Jim Peirce, Johnny Fitch, Dave Meeker, Phil Bates,** and **Nish Cornish.** There are five other class officers, but they are appointees: Class Agent, **Frank Shaw;** Estate Secretary, **Hood Worthington;** 50-Year Reunion Chairman, **Paul Cardinal;** 50-Year Reunion Gift Chairman, **Jack Hennessy;** and Alumni Council Representative, **Herb Stewart.** A fine body of men!

After the banquet we retired to a nearby lounge and heard Professor Thornton (Electrical Engineering), ably abetted by Mrs. Thornton, tell of last summer's great transcontinental Electric Car Race, which M.I.T. students lost to Cal Tech by half an hour. Then to the Grille Room for nightcaps and more conversation, and so to bed.

On Sunday our reunion officially came to an end. Many drifted off after breakfast, others stayed through lunch. In addition to what we may have picked up at the Flea Market, we carried away with us very attractive pewter mugs, mementos of the occasion; tape measures (Allegheny-Ludlam's best steel); tie claps with little lanterns that lighted up (courtesy of lighting mogul **Frank Manley);** miniature Mexican sombreros suitably inscribed; and copies of a recent nature book for children which suddenly appeared in quantity on Saturday night and were distributed generally, much to your Secretary's utter and complete amazement.

Long distance honors went, as usual, to Nish and Luisa Cornish, all the way from Mexico City, but not far behind was the California delegation, the Bateses, MacCallums, and Sinnickses, the J. Adalberto Roigs of Puerto Rico, and the Conways, Fitchs, and Sterns of Florida. And honors for the whole affair, including finding the club in the first place, went to Russ Ambach, a chairman with broad shoulders. Of the 129 at Bald Peak (68 classmates, 61 wives), something like a third journeyed down to Cambridge. Liz and Jim Killian, '26, joined them for cocktails on Sunday in the Student Center, as did Luis Ferré, and after a buffet dinner most retired early. Still to come up was Alumni Day on Monday—and yet another social hour. They needed to store up a bit of extra energy!

Alumni Day has been fully reported elsewhere, so there is no point in being repetitious. In case you missed it, though, you should know that two distinguished alumni received impressive Silver Steins on that occasion "in recognition of outstanding service. . . etc." His classmates gave one to Massachusetts Governor Francis Sargent, '39, we presented the other to Puerto Rico's Governor **Luis Ferré.** Luis was also given a plaque by Boston Puerto Ricans, a very pleasant switch from the whispered word beforehand that a group of dissidents was planning a demonstration.

So that, in its briefest possible form, is the report of our 45-year reunion. One thing that distinguished it from its predecessors was the number of classmates who were attending their very first. This was undoubtedly a function of retirement with time available as never before, relief from the care of growing families, and, in many, a new-found desire to travel. It was great to have them with us, but too bad they waited so long. They certainly joined the hardy perennials in saying "Had a wonderful time—glad I was there."

Next month, back to more mundane things. On second thought, considering what some of you people are doing these days, maybe not.—**Henry B. Kane,** Secretary, Box 177, Lincoln Center, Mass. 01773

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As all members of the Class are aware, we are now entering our 45th year as members of the Alumni Association of M.I.T. and are looking forward to our 45th reunion in June of 1970. **Sam Spiker, Ed Kussmaul** and **Jim Howard** visited Bald Peak in New Hampshire while the Class of 1924 was observing its 45th and report many favorable aspects of that location for the reunion. You will be hearing more from them during the year. These three "old faithfuls" —Sam, Ed and Jim—were also in attendance at the Alumni Day (Homecoming) affairs on last June 16. In addition, we were joined by **Milt Salzman** and **Wilard Allphin.** The Alumni Headquarters informed your secretary that **Forrest B. Kent** was also present, but unfortunately none of us were able to locate him.

Your secretary attended the Annual Meeting of the American Society for Engineering Education at Pennsylvania State University during the last week in June. One of the highlights of that meeting was the awarding of honorary membership to **Morrough** (Mike) **O'Brien.** This is indeed an honor; and for all of his contributions to the A.S.E.E., Mike certainly merits being one of the few who have been selected for honorary membership.

Further retirements: Notices reaching your secretary via Alumni Association Office indicate that **Cornelius J. Enright** retired from the New York Telephone Company in 1968 and is enjoying many activities. . . . **John** (Jack) **P. Ramsey** retired from the New Haven Railroad (now Penn-Central) Accounting Department August 31, 1968 and has moved to Bayshore, Oconee County, S.C., where he plans to take life easy for the next 34 years. He says that having worked for 34 years for his pension, he plans to live 34 years more to enjoy it! . . . **James Creveling** has now retired to Birmingham, Ala., having left the U.S. Steel Company on January 1, 1969. The four years prior to his retirement were spent with the International Department in Spain as a mining consultant.

A note from **Henry Chippendale**'s wife brought the information that last February, while they were in Portugal, Chip had a severe cerebral hemorrhage. He has made excellent progress and soon hopes to be driving his car and playing his favorite game of golf. Since this note carried a postmark of last May, we hope by now Chip is enjoying these activities.

A note from **Kamy Kametani** reached your secretary by a devious route, and indicates that he plans to attend the 45th reunion in June of 1970, possibly accompanied by his wife in kimono if finances permit.

The death of **George C. Caine** was reported in the last issue of the 1925 class notes. Since that time, a letter from his sister, Mrs. H. L. Kochenberger, to the Alumni Association brings further information regarding George. Of particular interest was information concerning his retirement party, and I am taking the liberty of quoting Mrs. Kochenberger's letter: "He retired from Getty Oil Company in May, 1968. A cross section of national oil industry representatives and Delaware business leaders, numbering more than 400, honored him at a Hotel duPont dinner and reception. People came from all over the country, from the Pacific Coast to the Atlantic Seaboard, to attend the affair. Telegrams poured in extending good wishes from this country and abroad, one coming from a Japanese friend. He had earned not only the respect of those who knew him but also their affection. He was not only a successful engineer and industrialist but a successful human being. He had a great capacity for love and devotion to his family, and innate kindness and courtesy, and a keen enjoyment of life."

I am sorry to report a number of other deaths, most of them quite belatedly. A note to Chink Drew from Henderson L. Holman, III, told that his father, **Henderson L. Holman, Jr.,** died suddenly on December 27, 1967. He was stricken with a fatal heart attack while walking home from work, in Ozark, Ala.

Thomas E. White died in Brookline, Mass., on October 2, 1967; **John W. McAuliffe** died in Quincy, Mass., on August 5, 1968; and **Harold E. Bawden** passed away in Plainview, Texas on August 10, 1968.—**F. L. Foster,** Secretary, Room 4-144, M.I.T., Cambridge, Mass. 02139

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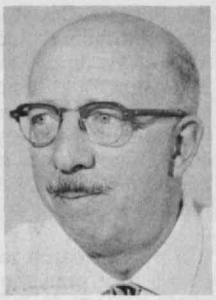
The summer is not quite over as we write the week before Labor Day, but there is much news dating from Alumni Day June 16—one of the few your secretary has ever missed. Having always avoided athletics of any kind it was disgusting to snap a planterus leg muscle, just like the ball players, a week before while walking at a leisurely pace. A dozen classmates did make it though: Chet Buckley, Walter Campbell, Larry Cumming, Bob Dawes, Bob Dean, Stark Draper, Esther Frutkoff, Jim Killian, Ben Margolin, Elton Staples and Morris Minsk. Not a bad representation for our Class in a non-reunion year.

Morris Minsk stayed in the Boston area for some time and after the Apollo moon landing he became so excited about **Stark Draper**'s contribution to the unbelievable effort, that he called your secretary and **"Pink" Salmon** and came to town for a little private luncheon commemorating the affair. For years we have been reporting the gold medal awards Stark Draper has received, almost to the state of boredom—ho-hum, another medal. The moon landing was the culmination of his achievements. We have read that as many as 400,000 people worked on the project making it the greatest team effort of all time. However *Time* magazine singled out the top three members of the team—John C. Houbolt who conceived the rendezvous method permitting a smaller launch vehicle, Wernher von Braun the driving force behind the project and our classmate: "Dr. Charles Stark Draper, 67, director of the Instrumentation Laboratory at the Massachusetts Institute of Technology. To solve the problems of navigation, NASA went straight to the nation's leading authority on inertial guidance. The system devised by Draper for Apollo includes telescopes, a sextant, and a computerized inertial reference 'platform' that tells astronauts where they are in space, where they are headed and how fast. But how could they be sure that it would work?, the NASA brass wanted to know. 'I told them I'd go along and run it myself,' recalls Draper. The onboard navigation systems have proved so accurate that, if they had to, the crew of Columbia could fly to the moon and back without help from ground controllers." One nice thing about the Class of '26 is our ability to bask in the reflected glory of our many achievers. Stark reflects as much glory as possible —just walk out in the full of the moon and bask in it!

This appears to be the peak year for '26 retirements and your class secretary's retirement will coincide with the publication of this issue. Therefore we hope there will be more time to put together a retirement issue in a month or two, even though we are taking over the running of a new business as a retirement project. We have had a most active and most frustrating sailboat racing season. At the end of last season we had our "Bullseye" cranked up so no one could get near us. We were going so well that the boat seemed to deserve new sails, better hardware, halyards, etc., which she got. As a consequence we have been fighting to keep out of last place all season. Yesterday, a competitor became ill at race time and turned his boat over to a twelve-year-old boy who had never skippered a "Bullseye" and when the boy went through our lee at the finish line we were ready for a holiday.

It takes a real attraction to pull us away from the sea during the summer months. The attraction was a visit to **Jim** and Liz **Killian** at their summer place near Peterboro, N.H. We left the "Bullseye" in the hands of our worthy crew Warner Wick, brother of Emily Wick, Associate Dean of Students at M.I.T. (Emily also races a "Bullseye."). We thought the Class would be interested in hearing about the place where Jim and Liz spend their leisure time, so we will give you a thumbnail picture. The drive from Pigeon Cove is only one hundred miles, but it is a different world. A map prepared by Chick (Kane), '24, made it easy to find, skirting Nashua, and turning south a mile short of Peterboro to the town of Sharon. The different world we speak of is largely in lush growth and in panorama. Whereas we have to studiously select and nurture every bush that will survive the ocean storms the first things we saw upon entering Jim's driveway were tomatoes growing upon what we would consider small trees. Instead of ocean expanse they have regal mountains. The house is rather high above the road and without asking you know that it must be several hundred years old—enormous chimney—five dormers, beautiful old pine panelling. When Jim and Liz acquired the place three years ago an addition was needed. This was done so skillfully that there is no perception of where the new begins

E. E. Mott, '27



C. T. Barker, '27

and the old leaves off. The new has a second floor deck surrounded by a balcony of roof siding that melts unnoticeably into the main roof. The principal function of the addition is to provide a liveable room with a vista—never found in a really old house. The view from this room is breathtaking—mountains superb. Up on the hill in back of the house, stretched between a couple of trees, a king-sized string hammock looked most inviting. A friendly dog, Nutmeg, came to us magnetically, but when we called Nutmeg *she,* Jim's grandson quickly advised that Nutmeg was a boy. Upon returning to Pigeon Cove we rushed to the phone to see how our boat, which, incidentally, is named Beaver, had done. Our crew had turned in a third place and reported that the boat went up wind like a streak. All along my friends have been intimating that a new "Nut on the tiller" could solve a lot of my problems. However, having tasted blood I won't be satisfied until I get the boat moving again. I took last week as vacation and one morning who should phone but **Don King** who was in the harbor aboard a sixty-eight-foot yawl cruising up the coast to Maine. Don has been retired five years. His avocation is running yacht races all summer on Long Island Sound, and planning them all winter. It was nice to see him for his brief stop over. We are using more space than '26 should, so a quick Cheerio until the Christmas issue.—**George Warren Smith,** Secretary, P.O. Box 506, Pigeon Cove, Mass. 01966

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After more than 40 years of management leadership in the chemical processing industry, **Bill Taggart** has retired from his position of executive vice president of W. R. Grace and Company's Industrial Chemicals Group. He was president of Grace's Dewey and Almy Chemical Division until his present appointment, and had joined Dewey and Almy Chemical Co. following his graduation. He became vice president in charge of manufacturing in 1948, executive vice president in 1956 and president in 1966. Bill's M.I.T. career has also been outstanding; he served as a member of the Executive Committee of the Alumni Association, was elected vice president of the Association in 1959, and president in 1962. He is also a member of the M.I.T. Faculty Club and has served as a term member of the Corporation. Always an outstanding member of our Class, we wish him happiness in retirement.

Tom Barker (officially Charles T.) has written us interestingly on the occasion of his retirement. My thanks and good luck, Tom. He says: "After 42 years in various aspects of the chemical business, I am going to retire on my 64th birthday. For the last ten and one-half years I have been manager of engineering for the chemical division of Vulcan Materials Co. This division is chlor-alkali and chlorinated solvents mainly. We have been located in Wichita, Kansas and have thoroughly enjoyed our stay in the Great Plains. Dot has had some health problems during the past year, now under control. We built a house on a waterfront lot we have owned for 23 years in St. Petersburg and have moved all our furnishings, including a loud-mouthed Siamese cat, into it. We will arrive there by way of Washington, D.C. (son Charles now stationed at Pentagon). Plan to do a little consulting, to provide mainly for foreign travel for both of us and enable me to increase and update my color slide collection." Tom's new address is 1935 Bayou Grande Blvd. N.E., St. Petersburg, Fla. 33703.

Professor **S. Stuart Barker** has written of his retirement in June of this year; his address is 1970 Summitt, Salem, Ore. 97304. . . . Professor **Paul C. Eaton** retired as dean of students of Caltech in June of this year. We have written before of his summer base in Maine and his address year-round is now West St., Kennebunkport, Maine 04046. P.C. writes that he will return to Caltech in January to teach two English courses for the winter and spring terms. No calculus? . . . **Laurence T. Littlefield** has retired from Eastman Kodak Co. and will continue to live in Rochester, N.Y. . . . After a 39-year career with Bell Telephone Laboratories, **Edward E. Mott** retired last March. In his specialized acoustical work at the Whippany, N.J., laboratory, he developed important underwater sound instruments for government military projects, and many types of telephone receivers. He has been granted 19 patents and is a Fellow of the Acoustical Society of America. Ed and his wife live at 44 Elm St. in Madison, N.J., have three children and eight grandchildren. . . . **Eugene N. Geisel** retired last May and lives at 5 Durant Rd., Wellesley, Mass. 02181, and **Frederick A. Bodden** retired from the Mirro Aluminum Co. last May.

At its annual banquet meeting last May, the M.I.T. Club of northern New Jersey selected **Russ Westerhoff** as its Outstanding Alumnus of 1969. A. Donald Green of the class of 1926, who received the award last year, made the presentation remarks, which included the following interesting account of Russ' career accomplishments: "Starting in 1928, his entire industrial career has been with Ford, Bacon and Davis, the New York firm of engineers, constructors and management consultants. From 1933 to 1937 he served as captain in the U.S. Army Reserve Corps engaged in supervision of construction projects related to the C.C.C. In Ford, Bacon & Davis, Russ rose through the firm's valuation and engineering departments, becoming manager of the engineering department in 1950, vice president and chief engineer in 1959. Then, in 1965 he was made president, and additionally in 1966, became chairman of the board.

"His professional activities have ranged from economic reports to plant design and construction. He is a licensed professional engineer in 12 states and has supervised many construction projects in the U.S. and Canada. In his contribution to the synthetic rubber program in World War II, he became project manager for the large alcohol-butadiene plant and styrene plant at Institute, W. Va., which were particularly important to the war effort. Recently, he has directed comprehensive engineering and cost studies on several phosphate fertilizer projects.

"He is a member of eight professional engineering societies, and of the National Panel of Arbitrators, the American Management Association, the President's Association, is serving a fourth term as chairman of the Business Advisory Committee of the National Association of Soil and Water Conservation Districts, as well as being a member of the National Resources Committee of the National Association of Manufacturers. In addition to all this he is active locally in

the Passaic County Engineering Society, has contributed much time and effort to the New Jersey Society of Professional Engineers in its committees for scholarships, law review and public relations, has been active for years in the various M.I.T. fund drives, and in Ridgewood's community chest." A truly remarkable record!

Our own research reveals that Russ is also a past president of the M.I.T. Club of Northern New Jersey, as are two other members of the class, **Don Spitzli** and **Glenn Jackson.** We were happy recently to get a nice, newsy letter from Glenn. He was enthused about the four months he spent in Recife, Brazil. He worked for the International Executive Service Corps (I.E.S.C.), a non-profit organization which, Glenn says, "all members of our Class should investigate, if they really want to help industry in friendly developing countries and see the world at the same time. My effort was confined to two textile plants about 15 miles out of town and although my Portuguese never got efficient enough for intelligent conversation, top management thankfully spoke English. We liked the Brazilians and their country as well as their food, and I'd go back at the drop of a hat. Got home and we both went to work seriously on the 'old homestead' in Amherst, N.H., that really hadn't had any attention on the outside for three summers due to our absence. Still slaving away at it, but it's my favorite work and I love it. Since December, I've been back in the textile business in New Jersey, which makes weekend commuting to N.H. a time-consuming traffic battle, but I haven't yet reached the time when I will have a desire to retire and will keep this up for a while." For those of you who want to take a step in the direction of Glenn's advice about the I.E.S.C., the address is 545 Madison Ave., New York 10022. The director of executive selection is Mr. Cook. Finally, thanks to Glenn for details of the above Westerhoff award; Glenn attended the meeting.

Joe Melhado, as class historian, has received Bill Kaplan's slides of the 40th reunion and promises to take good care of them. Joe and his wife, Marion, have just been on a first trip to Europe and he writes: "We had been talking about it for several years and with both kids out of the house and on their own, there didn't seem to be any reason to put it off any longer. We were in Rome, Venice, Florence and Paris and enjoyed them all. We shall want to go back again to all but Venice, which I think we covered adequately in a few days; any of the others takes months. Had very little difficulty dredging the French out of the memory register, but my Italian was on a four-year-old level—a few stock phrases, a couple of hundred words, but no grammar. . . . I've been with Standard Brands since the war, for the past three years as director of the commodity research department, which I established. Its principal function is to advise on timing and prices for agricultural materials, such as corn and vegetable oils. Practically all of our products are made from agricultural raw materials. I still have two years to go to retirement."

Before his retirement, **Phil Darling** visited 60 campuses as recruiter, speaker and unofficial counsellor. He had more than the average interest in President Johnson's letter of May 6 to the alumni, concerning the recent problems and policies at the Institute. Phil has sent me a copy of his very thoughtful reply, which said in part: "I am gratified that you are defending in particular the Lincoln and Instrumentation laboratories. Without their contributions this country would be dangerously far behind in many of its capabilities, especially in national security. I deeply regret that small groups, vociferous in excess of their numbers by several orders of magnitude, presume to determine the needs of this country and M.I.T.'s involvement therein. Such a student assumes knowledge and experience —granted that it exceeds ours at the same age—which simply do not exist. Yet a handful cause great disruption, aided by outsiders, and by some faculty members, perhaps outstanding in other fields, who attempt extension of that experience to fields in which they may be neophytes.

"On the good side they doubtless are expediting some of the changes and adjustments which are inevitable in an educational system which is the cornerstone of a viable civilization. None, however, justify the abdication of responsibility by education's administrators to maintain progressive, disciplined programs. Reasonable dissent—yes; irresponsible opposition and illegal acts—no."

In a related vein, **Reginald Jacobs** has written: "Everything in moderation; that is why I am glad to see the present student body unrest at M.I.T. in moderation."

Just as regularly as clockwork, **Erik Hofman** has shown up again from Mallorca (Spain). He always calls up by surprise and then drops by for a visit. He is looking well and enjoying his retired life. He had a fine story of having tracked down **Hank Kurt** and his wife to their 25-acre island off Camden, Maine. Hank's address is South Brooksville, Maine 04617.

I noted that **Leroy Miller**'s address had changed significantly—from Liberia to Ohio. A later note from Lee explained it all: "Change my address from Lutheran Church in Liberia, Monrovia, to 855 Pleasant Ridge Ave., Columbus, Ohio 43209. I've completed my tour of duty as building engineer for the church in Liberia after which I completed in two months a tour around the world. The U.S.A. still has many, many friends in the world!" . . . **Ed Damon** continues to come up with travel ideas which he enjoys. His last postcard recounts flying over the Arctic Circle and taking a peek at the fabulous North Slope, with plans to see Mt. McKinley—probably from the air, too. . . . **Dick Cutts** is enthusiastic about Boca Raton, where he spent last winter "with lots of sun, some of it liquid."

There have always been a few names in my class files for which I virtually or completely lacked information. One of these was recently cleared up considerably when I received a copy of an article "Opportunities for Women in Medical Research" by **Olive W. Smith,** Ph.D. While we were in our undergraduate years, the former Olive Watkins was working for a doctor's degree at Harvard Medical School. Mrs. Smith relates that "Not all courses were open to women, either at the University or the Medical School. I had to go to M.I.T. for advanced organic chemistry, to Harvard Summer School for physical chemistry, and there was no place in Boston where I could take anatomy! . . . After all this, the female candidate who survived could not get a degree from Harvard." Mrs. Smith was the first woman Ph.D. from the department of biochemistry, but the degree had to be awarded by Radcliffe, with—as we now know—an assist from Tech.

We have word that **Allston D. Calhoun** died February 23, 1969. His residence was at 701 Highland Park, Greenwood, S.C. . . . **Gerard P. deWestfelt,** who was retired, died November 14, 1968. His home was at 240-58 42nd Ave., Douglaston, N.Y. . . . **Edward F. Fletcher** died May 14, 1969. He entered M.I.T. freshman year from Newton High School and graduated in Course X. A large part of his business career was with Lewi National Corp., of Dorchester, makers of heavy laundry and dry cleaning equipment. It will be remembered that Ned attended our 35th reunion. . . . The *Waltham News-Tribune* reported the death of **Mario A. Volante** on May 19, 1969, after a short illness. He was a native of Newton and a retired agriculturist of the Volante Farms, Newton Centre. One of his specialties was the celery seed business. He prepared for Tech in Newton schools and secured both a bachelor's and master's degree in Course X. He was unmarried; his home was at 391 Dedham St., Newton Centre.

Here follow new addresses received: Arthur F. Tallman, 828 New Hempstead Rd., Spring Valley, N.Y.; Joe B. Wertz, Box S5, Kailua Kona, Hawaii; Charles C. Smith, Industrial Air Co., P.O. Box 215, Back-Buxton Rd., Amelia, Ohio; William C. Erwin, 123 Channel Haven Dr. South, Wilmington, N.C.; Edward R. Coop, 46 Hope St., Rumfor, R.I.; George E. Alfred, 1800 Albemarle Rd., Brooklyn, N.Y.; George E. Popps, 7723 Roctn Ave., Chevy Chase, Md.; Miss Hilda Young, 113 South Ardmore Rd., Bexley, Ohio; William E. Tucker 12325 Filera Rd., Rancho Bernardo, San Diego, Calif.; Paul S. Vaughn, 74 Green Island Rd., Toms River, N.J.; Lester B. Woolfenden, 850 Carlton Rd., Westfield, N.J.; Vernon Gordon MacKenzie, Route #1 Box 335, Lighthouse Way, Sanibel, Fla.; Dr. Irving D. Thrasher, 1150 North State St., Chicago, Ill.; Percy L. Richardson, P.O. Box 51, East Andover, N.H.

The war dominated the notes of November 1944. Fred Willcutt and Jim Flagg were Marine Captains. G. Albro Hall

was an Army captain and wrote from "down-under." Leslie A. Kniskern was a Navy captain. These had just been promoted: Lt. Col. Harry B. Cuthbertson, Col. William R. Gerhardt, Captain Edwin H. Himrod, Maj. Eugene B. Lunden, Lt. Commander Francesco Marcucella, Lt. Col. Charles C. Smith.—**Joseph S. Harris,** Secretary, Box 654 Masons Island, Mystic, Conn. 06355

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Six years ago **Herm Swartz** graciously undertook to handle the assignment of class secretary which, of course, involves preparation of the class notes for each issue of the *Review*. During this time every available scrap of news regarding anyone in the Class has been deftly reported in the '28 notes. The only serious omission has been any news of Herm himself. This is due wholly to his modesty. Now that he is retiring as class secretary, it is no less than proper that we begin with a report on his activities.

Herm has his own business, New England Construction Publishing Co., which he established a few years after graduation. In addition, he has a controlling interest in the publication of *Constructioneer,* a magazine which serves the Middle Atlantic states. Among other miscellaneous enterprises, he has a farm in New Hampshire which produces high quality MacIntosh apples. Herm is President of the Lexington Rotary Club, a director of the Lexington Trust Company, and past President of New Hampshire Blueberry Growers Assoc., Souhegan Apple Packers Assoc., and New Hampshire Horticultural Society.

The Swartz family consists of Herm, wife Dorothy, and four sons: Richard, Herbert, Thomas, and William. You may recall that Herm served as editor for our 25-Year Class Book, a piece of work that required immense effort and he prepared the 40-Year Class Directory almost entirely by himself. On one occasion, **Jim Donovan** declared Herm's set of notes to be the longest and best in the entire issue. This kind of performance has been consistent and we commend Herm highly and thank him for the wonderful job he has done.

As a contribution to this month's news Herm has sent in the following: "Early in July I received a call from **Hy Weinberg** who was about to return to his home in Passe-A-Grille, Florida after a hernia repair job at the New England Baptist Hospital in Boston. Dorothy and I spent an evening with the retired Colonel at the hospital and we were both saddened at his report that his wife Valerie passed away at New England Baptist in September of 1968, only a few months after our reunion. Death was caused by a cerebral illness that could not be diagnosed by the Lahey Clinic medics.

"While on a tour of Colorado early last July, Dorothy and I expected to visit Mary and **Max Parshall** in Fort Collins but we learned that they had already moved to Hamilton, Mont. Friends of ours in Fort Collins told us that several hippie groups had bought or rented property surrounding the Parshall home and, due to noise and all-night partying, residence in the community had become unbearable.

"A letter I received from Max and Mary later in July confirmed this. However, before flooding the Parshalls with sympathy, let's keep in mind that they both are addicted to hunting and fishing and I'm sure beautiful Montana environments must have influenced their decision to move. We also assume that there is a circle of dedicated musicians the Parshalls have already joined." The alumni records show that the present address for Maxwell Parshall is at 1107 South 4th St., Hamilton, Mont. 59840.

Several other changes of address have been reported: Claude H. Rice, Apt. #1, 12803 Bloomfield St., Studio City, Calif. 91605; Theodore Packard, Reels for Industry, Box 386, Orange, N.J. 07051; Louis C. Miller, Apt. 33B, 7595 Los Osos Valley Rd., Los Osos, Calif., 93401; John G. Houpis, 9 Achileos St., Paleon Phaleroin, Athens, Greece; Captain Frederic D. Riley, Jr., Box #824, Kilmarnock, Va. 22482; Harold L. Geiger, 1211 W. 22nd St., Oak Brook, Ill. 60521; Haskel C. Needle, Apt. A—202, 254 W. Trenton Ave., Morrisville, Pa. 19067; Professor Shikao Ikehara, 2-19-20, Meguro, Honsho Meguroko, Tokyo, Japan 152.

Alumni Day activities, June 16, 1969, on the Institute campus were attended by Frannie and Jim Donovan, Betty and Carl Feldman, Rose and Maury Beren, Dorothy and Herm Swartz, and Walter Smith.

Jim Donovan always has been and continues to be the best reporter of class news. He writes: "I had occasion to make a quick trip to California recently and I rather naturally looked up our old friends Marjorie and **Bill Bendz.** Marjorie was out that day, but Bill and I had a chance to talk and I saw a clock that he had figured out the inside workings of and rebuilt so that it functioned. I also telephoned Edith and **Ray Wofford.** They had always been friendly and said that I should come see them and since I was in their part of California I decided to find their town—no luck. Some effort through the telephone company told me they lost the faith and instead of locating in Walnut Creek near San Francisco they have gone down near San Diego. In any event, I had the pleasure of talking with each on the phone and they sounded happy and, I trust, are enjoying retirement in southern California. They said that **Dud Smith** had read the class notes and came over to see them. The class notes do some good! Trust more people will respond in the friendly way Dud did. I also had a letter from **Bill Hurst.** Bill feels that a large number of things in this world are wrong, that too many

Herm Swartz, '28, former Class Secretary

of the administrators at M.I.T. are making news, saying things which he disagrees with, and doing it with the name M.I.T. tagged to them. A few of us knew adversity as Bill did as he went to school; few have had the success that Bill has achieved as an American and he has used his technical education and basic competence to achieve international recognition and success."

Joe Whitcomb who was recently elected President of the Middleboro Savings Bank wrote Jim Donovan on August 12: "Dear Jim, Thank you for your letter of August 8. It was good of you to take time out of a busy day to cheer up an old classmate. Actually, the duties are minimal and it is something to keep the think tank active and in line with my other activities—four trust funds, two cranberry companies, two banks, and treasurer of a new vocational school. One cannot retire and just sit after 40 years in the fire truck industry. Hope your interests are going well; these are tough days to run a business."

Several other classmates have been elected to positions of high distinction. The *Wall Street Journal* of July 22, 1969 notes that **Everard M. Lester** was elected Vice President of Foster Wheeler Corp., in Livingston, N.J., makers of steam generating equipment and builders of processing plants. . . . An Institute news release dated June 24, 1969 announced the election of nine members of the Corporation including **Elisha Gray,** Course II. Concerning Bud's professional background the release states: "Mr. Gray received the S.B. degree in management from M.I.T. in 1928 and for five years was with Sears, Roebuck and Company in Chicago and Newark. He became vice president and general operating manager of the Cutler Shoe Company, Chicago, in 1933 and joined the Whirlpool Corporation in 1938. He became vice president of Whirlpool in 1940, a director in 1943, executive vice president in 1947, was president from 1949 to 1962 and has been chairman of the board since 1959. He is a director of the Sears Bank and Trust Company and General Foods Corporation and a member of the board of governors of the American Red Cross."

On June 17, 1969, the American Nuclear Society announced the elevation of 10 members to Fellow of the American Nuclear Society. Included was our classmate **Dennistoun W. Ver Planck,** who is Assistant Director of Gulf General Atomic, San Diego, Calif. . . . **Al Gracia,** who has had a distinguished career of 40 years with Goodyear Tire and Rubber Company, Akron, Ohio, has retired as Vice President for Research. . . . **Bob Harris** has retired from the M.I.T. Faculty as a professor of nutritional biochemistry. His entire professional life has been devoted to service at the Institute. . . . The *Harvard University Gazette* of July 12, 1969, announced that **Mortimer Cook Budlong** had retired as Administrative Assistant in the Office of the Registrar of Harvard College and the Graduate School of Arts and Sciences, after five years with the Office of the Registrar. Mortimer retired in 1958 as Vice President of General Time Corporation where he had been since 1928. Following this he was a special consultant to the Crane Company and then was with the Massachusetts Crime Commission before joining the Harvard group.—**Walter J. Smith,** Secretary, 209 Waverly St., Arlington, Mass.

W. Gordon Bowie, '29 (right), presenting the Class of 1929 40th reunion gift to President Howard W. Johnson at the Alumni Day luncheon. The text of Mr. Bowie's presentation speech appears directly below.

"President Johnson—I am pleased to be here today and have the opportunity to announce the 40th reunion gift of my class of '29.

"As you well know, such an effort reflects the hard work of many people and I want to express my sincere appreciation to the class officers, Eric Bianchi, Frank Mead and John Rich, and all the members of the reunion gift committee who spent so many hours seeking individual support for this fund. Also, I would like to thank each class member who has contributed to this gift. . . .

"Five years ago when we embarked upon this project it was with some trepidation because as you recall our class became known as a depression class and we knew that all of our members had felt the effects of this period in some degree. Nevertheless, we set our sights high and after five years of effort, I am proud to announce the result.

"The gift from our active members to M.I.T. which we report today is $513,900. In addition, the Institute has received a bequest from one of our class members which has already exceeded three million dollars. These gifts received during our reunion period bring the total for our 40th gift to a new record of $3,590,000.

"President Johnson, please accept this gift from those whose names are listed in this booklet. This is an expression from our class of our loyal and enthusiastic support of M.I.T. and the things it represents."

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After five years of distinguished service, John P. Rich has relinquished his post as Class Secretary for a well deserved rest from its chores. Let us all give him a hearty *thanks* for a job well done. With a little hesitation, I have accepted the post of Class Secretary. The kind of a job I do will partly depend on you. Write to me whenever you can about yourself, your family and other classmates.

As a brief introduction, I was in Course XVII, building construction, which now has been combined with civil engineering. Some of you might remember me from your freshman year as I was selling K & E slide rules and drawing instruments to the incoming students, in competition with the Coop at 30 to 40 percent discount. It is possible that some of you might have purchased your first slide rule from me.

Our 40th reunion which took place at the familiar Wianno Club on Cape Cod, June 13-15, was well attended and proved to be a big success. There were 131 of us present, 60 couples and 11 singles. William Baumrucker, our 40th reunion chairman, wishes to express his sincere appreciation to the committee members and their wives for their time and effort which made our successful reunion possible.

Having reached a significant milestone in our lives and careers, with most of us either retired, semi-retired, or working just for the pleasure of it, to lean back, relax and enjoy ourselves, came naturally. This was the mood prevailing during the three memorable reunion days. Though the reunion committee, under the able chairmanship of William Baumrucker, had arranged a full program including fishing, golfing, sightseeing, etc., the most enjoyable pastime was seeing our old classmates, some of them for the first time since graduation 40 years ago.

Among those attending their first reunion and accompanied by their wives were: Seymour A. Baum, George A. Crandall, Frederick B. Danner, Stephen N. Dilworth, Edward R. Godfrey, Robert S. Pride, William C. Whiting, plus our genial bachelor, B. King Couper.

Some traveled long distances to be present; foremost among them were: **Arnold W. Ewan,** retired and presently living in West Germany, who traveled all the way from Munich to be with us. **Frederic A. Celler** and his wife Margery

came from France. Fred deserves a special comment for his work and effort in fostering better relations between two traditionally friendly countries, France and the U.S. He is a director of the American Chamber of Commerce in France and director of several Franco-American organizations. In 1962, he reorganized and revitalized the almost defunct M.I.T. Club of France. He says that today, 'it is a going concern with 100 members attending regular monthly dinner meetings." Among his hobbies he lists golf, history, and gastronomy. He is presently wine consultant for S.S. Pierce Co., of Boston. Others who traveled more than 500 miles with their wives to attend the reunion were: C. Brigham Allen, Jr., Murry Brimberg, George A. Crandall, Harold L. Halpert, John D. McCaskey, David D. Peene, Hunter Rouse, Samuel J. Shaffer, and Amasa G. Smith with Miss Julia Smith his daughter. Attending singly were John Butler, B. King Couper, Anthony J. Perry, and Elmer A. Skonberg.

Other couples attending were the: Earl Abbes, William Baumruckers, Eric A. Bianchis, W. Gordon Bowies, Arnold W. Contis, Richard J. Coveneys, Ralph Crosbys, Wilfred J. Danzigers, Marshall S. Davids, Karnig S. Dinjians, Paul F. Donahues, John J. Faheys, Edward B. Farmers, Charles Franks, Jr., Walter H. Gales, Vincent F. Gardners, Joseph Greens, Hugh G. Hamiltons, Lawrence C. Hamlins, Malcolm M. Hubbards, John F. Joyces, Paul V. Keysers, Jr., Virgil W. McDaniels, James B. Magenises, I. Theodore Malmstroms, Francis M. Means, Herman Meissners, George J. Meyerses, Jr., Laurence R. Moseses, Daniel J. O'Connells, Gerald A. O'Connors, Dexter T. Osgoods, Leonard C. Peskins, Frank O. Piersons, M. Edgar Powleys, Jr., John P. Riches, Edward C. Roches, Thomas H. Spellers, Joseph L. Speyers, Roger Sykeses, Warren W. Walkers, E. Neal Wellses, David H. Wilsons, John J. Wilsons, and W. Wirt Younts. Attending singly were: Mrs. John Booth, Mrs. Ruth Earle, Mrs. McFarland, and Mr. Thomas McCue.

One of my hobbies being photography, I have become the Allan Funt of our Class by taking candid movies. Anyone who doubts how much fun we had at the reunion should see these films of our merry-making. We have produced some very interesting and lively scenes, which we hope to show before 1974. Many joined in the fun and added their bit to make these movies a little zesty.

One special subject, the attractive wife of one of our classmates, performed a beautiful "rain dance" on the sands of the beach. It was a little cloudy at the time and it wasn't clear to us whether she was trying to bring rain or dispel the clouds. I wish she would come forward and identify herself so we can give her a proper billing when these movies are shown.

Friday evening just prior to showing slides and movies of past reunions, we held a short business meeting at which the following were elected class officers for the next five years: **Francis N. Mead,** President; **William Baumrucker,** Vice President; **Edward B. Farmer,** Treasurer; and **Karnig S. Dinjian,** Secretary.

Our Wianno activities ended Sunday afternoon when nearly half of our group showed up at President Howard Johnson's residence for a previously arranged reception and cocktail hour. A goodly number remained on campus for Homecoming on Monday.

It was a distinct honor for our Class that **Warren W. Walker** was chosen to give the eulogy this year at the Homecoming Memorial Service in memory of those alumni who had departed since June 1968. Here are excerpts from it: "These departed alumni, men and women, have made their indurate mark in the environment of our time. . . . We record, not with sadness, but with joy and exultation of spirit, their achievements. Our memories of many years of association are precious and golden beyond compare. We extend to their families, friends, and business associates, our recognition of their job well done.

"On such an occasion as this, let us dedicate ourselves anew to passing on to succeeding generations an economic, philosophic, and spiritual environment, enriched by our intellectual and technical know-how, the foundation of which was engendered by our alma mater.

"Let us not forget that great societies have become great because their people have striven and attained high goals for the common good. Let us continue our diligence in the quest for these goals, not forgetting that the greatest resource of any nation is its manpower enriched by the human spirit; particularly the professional manpower guiding our institutions and industries—the hallmark of our civilization."

At the Homecoming luncheon five or six tables displayed the numerals '29. This time we did not have to stand in line and help ourselves to food; it was served to us, indicating that we are on our way to becoming senior alumni who have earned their right to wear those colorful jackets. We still have ten years to go—let us not rush it! The climax of the luncheon for our Class was the presentation of our 40th reunion class gift to President Howard Johnson by W. Gordon Bowie (see photo and presentation speech on p. 154). Due to a special legacy our 40th reunion class gift sets a record not likely to be surpassed soon.

The suggestion has been made that we might undertake a get-together before 1974, which sounds a long way off. I understand some classes have annual reunions held away from the M.I.T. Campus to give those who live in the Midwest or on the Pacific Coast an opportunity to attend. I have received some interesting comments on this subject from a number of 40th reunion attendees. Have *you* any suggestions to send me? Don't forget to include a brief biographical sketch (if you haven't done so in the past year or so) and tell us about yourself and your family. With best wishes to you all—**Karnig S. Dinjian,** Secretary, 32 Oldham Road, Arlington, Mass. 02174

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As usual at this time of year, a respectable number of items have accumulated over the summer, so many in fact that I have decided to save some of them for the next issue. The accumulation includes two species of that *rara avis,* the unsolicited letter. **Reg Bisson** writes from Laconia, N.H., that he is owner of a construction firm that just completed the first new building in the Urban Renewal program in Laconia, a bank facility for the People's National Bank. He officially retired as Colonel, C.E.-U.S.A.R. last year.

As an active member of the Educational Council interviewing applicants for M.I.T., Reg maintains a lively interest in the Institute. The Bissons have three sons and a daughter: William, M.I.T., '60, who served three years in the U.S.A.F. and graduated from the Boston Architectural Center in June 1969; Elizabeth, who graduated from University of New Hampshire and teaches special classes at the Salem Massachusetts, Jr. High School; Robert, who is a student in Ocean Engineering at Florida Atlantic University, after field work as a diver technician, including work with the Jacques Cousteau organization in the Mediterranean, and work on undersea exploration in the North Sea and off the west coast of Africa; and John, who is a student at Belknap College in New Hampshire.

Mel Blackwood writes: "I started to plan retirement about five years ago in several stages. As you know, I worked at research and development in the textile industry most of my life since graduation, and then for eight years as technical assistant to the sales manager of one of the divisions of American Cyanamid. When the textile industry went South, I became interested in outer-space instrumentation, and worked on development of chemical and electroplating problems on communications switches; for one year I worked on selection of plastics for the Apollo vehicle and re-entry heat shields for Avco.

"I then decided that I needed summers to plan my retirement so I took to teaching physics and mathematics at technical institutes and junior colleges in Connecticut and New Hampshire. During the summers, I built a ranch house in Sanbornton, N.H., where I had previously purchased about 25 acres of land. My son, William, who was going to college in Tennessee at the time, helped for three summers to get the house in livable condition. I still have some things to do on the house and it has kept me busy. All in all, I gradually retired. And it's great! I get my exercise by walking a lot, and by cutting trees in the wood-lot for fireplace logs. I'm in pretty good shape.

"My son, Bill, is now graduated from Maryville College in Tennessee in business administration and is at O.C.S. Fort Benning, Ga. My daughter Barbara graduated from Douglass College, New Jersey, in biology. She is now married to a Coast Guard officer, Jim Blake, and they live in Miami, Fla. My wife, Lee is teaching the third grade in Sanbornton public school. She spends part of the summers working on her master's degree at Plymouth State College."

We have at hand notices that several more of our classmates have recently retired. Among these retirees is **Fred Dickerman** who retired last April as chief engineer—special projects and assistant to the director of engineering for the Lockheed-Georgia Company in Marietta, Georgia. After graduating from M.I.T. Fred started as an aircraft design engineer with the Stearman Aircraft Company in 1929. Thereafter he was associated with Berliner-Joyce Aircraft Company and the Chance Vought Division of United Aircraft prior to joining Lockheed-Georgia in 1955 as chief preliminary design engineer. He became chief engineer in June 1968. Fred holds several patents on aircraft design features and is a Fellow of the American Institute of Aeronautics and Astronautics and a member of the Society of Automotive Engineers and the National Aeronautics Association. He and his wife Katherine are planning to live in Pinellas Park, Florida.

Those of you who failed to read the last issue of the *Review* carefully may have missed the announcement of **Cecil Dunn**'s retirement as Associate Professor of Industrial Microbiology at M.I.T. During the past five years Cecil served as Graduate Registration Officer of the department; in this capacity he worked closely with the graduate student group. In collaboration with the late Dean Prescott, he wrote the first definitive text on industrial microbiology, which has now gone through three editions and has been translated into a number of foreign languages. On the occasion of his retirement, Professor Goldblith said of him: "Indeed, the greatest single attribute of Cecil Dunn's career has been his ability to reach students—to understand them and to help them."

Ed Rhodes retired as of the first of this year after 23 years working for the State of California. He and his wife Bernice live in Glendora and have three children: Robert, who is serving in Vietnam; Edward who graduated Phi Beta Kappa from U.C.L.A. in physics and did graduate work at M.I.T.; and Ada, who is in high school in Glendora. Ed did not give any details concerning his retirement plans.

It is regretfully necessary to report the deaths of several more of our classmates. **Ed Hill**'s death on March 4, 1969 was reported in the *Cleveland Plain Dealer.* After graduation from M.I.T., Ed was an instructor in the bio-chemistry department of Tufts University from 1931 to 1939 and received an M.D. degree from the Tufts School of Medicine. He served with the Army Medical Corps in World War II and for a period of 18 years was director of medical research at Ft. Detrick, Frederick, Md. He also served for a time on the staff of the medical school at Harvard and the staff of its legal-medico department. At the time of his death he was a forensic pathologist for the Cuyahoga County coroner's office and lived in Solon, Ohio. He is survived by his wife Katherine, three children and one grandchild.

Jim Dadakis was killed in an automobile accident in Elyria, Ohio on June 12, 1969, while on his way to the University of Wyoming in Laramie to take an advanced physics course as an N.S.F. award winner. As previously reported in the notes, after graduating from M.I.T. Jim worked with the Dollar Radio Co. for a number of years and in the late fifty's decided to change to teaching. He went to Teachers College of Columbia University, from which he received a degree in science and education in 1961, and thereafter taught physics in a number of schools including the Fieldston School in Riverdale, the Eastchester High School, the Westlake High School in Thornwood and at the time of his death, Westchester Community College. He is survived by his wife Demeter and a son Sophocles, who is in the Marine Corps and two daughters, Mrs. Robert Sharkey and Mrs. Roger Horn, and two grandchildren.

Supplementing the report in the June notes concerning **Ken Tator**'s death last January, we have at hand an item from *American Painting Contractor* indicating that Ken was a highly respected authority in the field of corrosion. According to this article, "He is recognized as the father of the 'Five-Mil, Three-Coat' coatings system and was one of the earliest advocates of cathodic protection through the use of sacrificial zinc coatings. His lectures at scientific symposia were familiar to a generation of painting contractors, engineers and technical coatings personnel." After graduation from M.I.T. Ken worked for 10 years as a design engineer for Dewey and Almy Chemical Co., specializing in product development work and quality control and then entered the private consulting field. During World War II he served the War Production Board in Washington in a number of different posts with the Bureau of Industrial Conservation and in 1949 founded Kenneth Tator Associates. He is regarded as the father of the Coatings Society movement in the U.S.—non-profit organizations whose broad objectives are to promote the exchange of information regarding technological advances in coatings for the benefit of members and as a public service. He was a member of the National Association of Corrosion Engineers, the American Chemical Society, American Concrete Institute and many other technical and scientific groups.

Changes of address: Kenneth G. Bucklin, 11 Pine Valley Circle, Ormond Beach, Fla. 32074; Mark C. Culbreath, Apt. 212, 4545 Wornall Rd., Kansas City, Mo. 64111; Fred N. Dickerman, Lot 101, 3401 Gandy Blvd., Pinellas Park, Fla. 33565; Dr. Cecil G. Dunn, Bald Hill Rd., R.F.D., New Gloucester, Maine 04260; Arthur C. England, Jr., 81 Arcellia Dr., Manchester, Conn. 06040; Douglas A. MacDonald, c/o Dr. J. P. Lautenslager, R #4, Rockwood, Ont., Canada; William J. Moody, 473 Palmetto Dr., Pasadena, Calif. 91105.—**Gordon K. Lister,** Secretary, 530 Fifth Ave., New York, N.Y. 10036

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It was good to hear from **Carl Connable** recently. His new address is 2819 Craycroft Road, Tucson, Ariz. 85716 and he wrote: "I retired a couple of months ago. For the 33 years preceding I've been making use of things I learned at M.I.T. both in class and on *The Tech* as an industrial advertising man—in succession as ad department writer (of sales bulletins and instruction manuals), ad manager, agency account executive (on plans, copy and client contact), one-man-agency operator, and consultant. It's been fun, and with spare time due to arrive any week now I look forward to doing some writing on my own." Carl also asked about the old *The Tech* newsroom gang, Tul Huston, '33, Ralph Davis, of our Class, Lou Verveer, '30, and "Dan" Danziger, '29, and the rest.

Herb Chandler proudly reports that his youngest daughter, Candy, has been accepted at Yale. She was one of two girls accepted in the Baltimore area for the co-educational program recently instituted at Yale. She attended Mount Holyoke last year and will enter Yale as a sophomore. Herb, incidentally, is Engineering Director with the Department of Defense. Candy is working as an Apprentice Engineer at the Westinghouse Defense and Space Center during the summer.

Joe Brennan recently retired from the Federal Government after 32 years in water resource development in the Executive and Legislature Branches. He is now doing consulting work out of Washington, D.C.

Louis Evans reports he has just completed 32 years with the Research Department of Mobil Oil Corp. Currently, Lou is running the training programme for technical personnel in Mobil's worldwide manufacturing operations. It was a new project he undertook in 1964 and has developed into a very successful and stimulating career activity. This year, Lou and his wife spent their vacation in Portugal, Spain, Italy and in Sweden where he has a married daughter.

John Turner is designing the new State Supreme Court Building as a master-planned Government Center. . . . **John Vincent** writes that he is well, happy and retired. . . . Congratulations to **John Dodge,** staff member of the Educational Development Center in Newton, Mass., upon has citation by the American Physical Society and American Association of

Physics Teachers for his work in developing new physics materials for high school teachers. . . . Congratulations also go to **Gordon Brown** on his appointment as head of the Commission on Education which has officially become part of the National Academy of Engineering. . . . Word has just been received that **Chuck Starr,** Director and Vice President of Esso Research & Engineering, retired on August 1. . . . **George Bunker** has been elected to Harvey Aluminum's board of directors. . . . **Bob Marcus** has been elected chairman of the board of American Biltrite Rubber Co.

Now the only part of being Class Secretary I don't like—reporting the death of classmates. Since the last notes, word has been received that **Percival Elbaum** passed away on April 22, 1969, and **Edgar Sniffen** on February 4, 1969. Our deepest sympathy to their families.—**Edwin S. Worden,** Secretary, 35 Minute Man Hill, Westport, Conn. 06880

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The first order of business this new year is to correct the misinformation I published in the June issue. I have the following letter from the real **Robert D. Butler:** "I have been married to a lovely American girl, Eloise, all these many years and have never encountered Senhora Dinair to whom you reported my marriage in the June Class Notes. After the second war I worked briefly for National Lead, then shifted to Bethlehem Steel Corp. After a stretch in Africa on exploration, I was assigned to Brazil in 1949. Together with our Brazilian partners we developed the largest manganese ore mine in the Western Hemisphere, currently shipping about one million metric tons per year. The mine is located in the center of Amapa Territory, to the north of the Amazon at its mouth. Eloise and I lived at the mine camp during the exploration phase and later moved to Macapa on the north bank of the Amazon at latitude zero-zero. In view of this circumstance I think I can claim the class record for crossing the equator—at least 3,000 times. We lived in the territory for 12 years and since 1961 have been in Rio. We are just now closing our affairs here and will retire to the States on August 31, 1969. Our continuing address will be c/o Mining Dept., Bethlehem Steel Corp., Bethlehem, Pa. 18016, until we establish a permanent one." Robert continues with a description of the astounding magnitude of the Amazon which I will find room for later.

Ralph W. Crary writes, "I retired from Chevron Research Co. on March 1, 1969 after thirty-six and one-half years of service, will continue to reside at 6210 Winston Drive, Bethesda, Md. 20034." . . . **Derwood M. Danforth** writes, "Still with the Singer Company (23 years) but now at the Elizabeth, N.J. plant rather than in Executive Offices, New York. Technical Administration work in the Product Development Department of the North Atlantic Consumer Products Group. Have two children, daughter attending University of Rhode Island, son (14) entering high school in September." . . . **William I. Stieglitz** writes, "Still involved in aviation and automobile safety. Had the opportunity recently to lecture at the Royal Institute of Technology, Stockholm, at the first international course in Automotive Accident Prevention. It was sponsored jointly by that institute and the University of Southern California with 11 countries represented; it was an interesting exposure to attitudes. Found many ahead of us!"

Karl E. W. Hellsen writes, "After these many years in the engineering and construction field, I am about ready to retire to the South, Florida and Mexico." . . . **John A. Fellows** writes that he has "engaged since mid-66 in supervising the technical programming activities of the American Society for Metals. Please note that Professor Morris Cohen of M.I.T. will be president of this society beginning in October this fall." . . . **Leo T. Tyburski** writes, "My daughter, Thea, graduates from Syracuse University with a major in drama—made the Dean's list which is better than I did! My son, Thomas, is a sophomore at Kings College—doesn't know whether he'll be in engineering or sociology! On May 10 my wife Norma (also a Syracuse grad) and I are going to Europe and will visit London, Paris, Amsterdam, Florence, Rome, Lucerne and Lisbon. That will be my 2nd visit and my wife's 6th abroad—Cheerio!"

Erskine G. Roberts writes a personal note confirming his joining P & W Inc., as Principal Engineer, Assistant to the Vice President—Marketing, where he will search for new business in environmental engineering. . . . **Richard W. Berry** has been elected Senior Vice President of the United Fruit Co. He will be responsible for long-range planning of the company's world-wide transportation and distribution systems. Dick, a career employee of United Fruit Co., was named Assistant to the Vice President in 1942, Assistant Vice President in 1948, and Vice President of Transportation in 1962.

Jim Harper, our Washington, D.C. based class secretary writes that he spent a week in June as a student at Catholic University in the course: Statistics for Engineers and Scientists, and expects to attend our Class Secretary Workshop at M.I.T. on September 4, 1969. Jim had a call from **Stan Johnson** who was visiting Washington with his wife Johnnie, a delegate to the D.A.R. convention from New Rochelle, N.Y. Stan is a Course I civil engineer and serves as consultant to Howard Needles, Tammen and Burgendorf Engineers, New York City. He has a branch office in Fairfield, N.J., and is currently engaged in widening the New Jersey Turnpike. Last summer Stan won a cup in the International Class sailing in Long Island Sound.

Robert W. Bashnagel has been promoted from General Sales Manager to Vice President of Sales by the Rochester Gas and Electric Corp., Rochester, N.Y. . . . **Richard L. Morgan** was presented with a framed letter in appreciation of his services as Acting Executive Officer of the U.S. Army Mobility Equipment Research and Development Center, Ft. Belvoir, Va. As a retired Officer, Richard was detailed as Acting Executive Officer in mid-1968 because of a shortage of officers and filled the assignment until April, 1969. He served in the Army from 1940 until his retirement as Colonel in 1960. Since his retirement he has been employed at the R&D Center, which is responsible for research, development and engineering for round-the-clock mobility in some twenty fields of military engineering ranging from mine detection devices to water purification equipment. He is a member of the Society of American Military Engineers, the Retired Officers Association and included in his awards and decorations are the Bronze Star, the French croix de guerre, and the Korean Order of Military Merit. Richard resides with his wife at 7401 Gatewood Court, Alexandria, Va.

The M.I.T. Alumni Records apprise us of the death of **Richard B. Sheridan,** 29 Colton Dr., Buffalo, N.Y., on July 1, 1968 and the death of **Philip R. Mayo,** 4935 Alexander Dr., Clarence, N.Y., on March 11, 1969.

The final item is a report from **G. Edward Nealand** on his survey for the interim reunion detailed in the May issue. As of August 1, we have received 15 letters saying, "let's hear more about Barcelona in 1970." We have not heard from many who have attended previous reunions and we feel sure they'll want to be included in a Class of '32 trip to Spain in the summer of 1970. It's hard to plan if we don't know how many would be interested. Please take a minute and send a note to Ed Nealand, Room E18-360, M.I.T.—**Elwood W. Schafer,** Secretary, Room 13-2145, M.I.T., Cambridge, Mass. 02139; **James Harper,** Assistant Secretary, 2700 South Grant St., Arlington, Va. 22202

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Well, folks, we are again at the post, for the 72nd running of the *Technology Review* Sweepstakes. I cannot say that I am disappointed, as, believe it or not, much material accumulates over a short two month writing lay-off. One of our more distinguished classmates leads off this time, **Don Fink,** General Manager of the I.E.E.E. In reply to a personal note of mine, Don added a P.S. and enclosed a list of M.I.T. alumni who are members of the National Academy of Engineering. The Academy has a total membership of 280 with M.I.T. men counted at 60 which is 21.4 per cent of the total. We submit that, considering the great number of engineering schools all over, our 21 + per cent looms rather large. However, the list by classes shows 1933 doing quite well, tied for second place. Our five members are: Ralph E. Cross

of Detroit; Donald G. Fink of New York City; Ivan A. Getting of Los Angeles; Edwin R. Gilliland, Professor at M.I.T. and, Philip C. Rutledge, of New York City.

We have a nice postcard, a picture of the Rhode Island State House, from **Margaret Kelley Geddes,** this in response to one of mine. (These Kelleys do pop up, no?) She reports missing the A.I.A. convention in Chicago, so has no news about any Alumni. Apparently the Geddeses are sail racing fans as she says that they are "sending one off to *Block* Island, and one to Cork." This is not self explanatory, so I will now await her reply after she reads this in early October. . . . Now comes our own **Gerard** (Gerry to you) **Kincade** with a most carefully prepared biography, and naturally, in response to my request. I quote, "I know that I have been remiss over the last 35 years in supplying information about myself. My wife [the little darling—Sec.] Dorothy has been prodding me most actively for the past month to do some writing about the family." Many, many thanks, Dorothy, and you may be sure that my idea of writing to the gals had at least some merit. Now I turn to a three page tome which cannot be included as is, but is easily paraphrased. Gerry was with ROBERT GAIR Company from 1933 to 1943 as Trainee, Salesman, Plant General Manager, via Connecticut, Syracuse, and thence to Cleveland, where he went with General Container Corp., as Plant Sales Manager in 1943. He was with General Container, as Plant Sales Manager, Vice President, until 1955 when General Container merged with St. Regis Paper Co. From 1955 he was with with St. Regis, Cleveland Corrugated Box Division, as Plant Division Assistant General Sales Manager until 1963 when he moved to Pittsburg as Divisional General Manager, and is now Vice President and Divisional General Manager. That covers Gerry in some detail, and one may well see that the road was long, but not too rough.

Our Southwestern Diplomat, Vice President **William D. Harper** has a bit of news for us. Bill describes in detail his amateur railroad setup, Bobbie's Hobbie. I think that they have a maximum of track on a 9 ft. by 9 ft. table. Apparently, the table is hinged at one end, so that it becomes easy to work on the two sets of tracks, both O Gauge and Standard. This double set may not be unique, but it is new to most of us. It must be quite a setup. Bill's recreation now is the 18-foot boat, a Crestliner, with Mercury's latest outboard motor, an 80 h.p. deal, yet. They keep the boat in one section of a three-car garage, leaving room for two cars, one for each of them. It takes 30 minutes to get the boat into Galveston Bay. Bill sent me copies of two fine letters written to classmates in Texas, as part of the opening guns for the 40th Fund. Thanks, William!

Mal Mayer seems to be back after much flying around the world in the interests of beer consumption et al. Mal has tried repeatedly to contact various and sundry of our foreign classmates; this time he had the same success; none at all. In London, Mal found that **Robert Dodd** had retired, and was making a tour of Europe over a period of 2 years. Mal's informant had heard that Bob was spending 3 to 4 months in Geneva, Switzerland, but, Mal did not get to Geneva, so he missed Bob again. Mal also tried to contact **William L. Scarborough,** who lives in Geneva, but again with no success. Well, Mal, you surely try, and perhaps you try too hard.

Wonders will not cease, ever, or so it appears. We have a letter here from another of the distaff side, Mrs. **Olavi** (Marie) **Viita.** Marie wrote because, first, I did appeal to the girls, and second, because Olavi is very busy on plans for a new summer home at New Seabury, on Cape Cod. The Viita family is really going to town, what with son Paul at Harvard. He was elected to Phi Beta Kappa, while still a junior. Daughter Mimi has just completed her freshman year at Smith in Northampton, Mass., and, Mimi is elated to be under consideration for a semester at Williams College, as an exchange student next fall. Mimi was selected for a whole year, but she seems to favor the half-year so as not to get out of touch with affairs at Smith. Paul is hard at work majoring in math and history, while Mimi is an art major. Both children will visit Europe this summer, but the old folks will stay at home and, among other things, will visit friends on the Jersey shore, who hail from Wilmington.

Ere I forget, please recall a short article in these pages about my correspondence with the Reverend Father **Bernard Doucette,** S.J., who suggested that I contact a young priest living at St. Andrews House on Newbury St., Boston. I did just that early in the spring, and I sure enjoyed the young man, Reverend Father Alfredo Navato, S.J., who is attending M.I.T. as a graduate student, working for his doctors degree in the meteorological division of aeronautics and astronautics.

The rat race is for rats

We have a short letter from **William E. Rand,** our Pacific Coast Diplomat, who really has moved. Bill seems to have decided that the rat race is for the rats, and has given up his position with the land and cattle people, somehow connected with *Fortune,* and moved bag and baggage to Sea Ranch, Calif. Where's that? Well, I had to look it up, and it is on the shore, about 100 miles north of San Francisco. He and Jean are now living on the ranch where he is General Manager of the Sea Ranch Association, which apparently owns the business. Bill is working at a salary of about 25 per cent of his former stipend, and loves it: Chamber of Commerce stuff—good fishing, surfing, skin diving, and plenty of good beaches. The development has a store, hotel, restaurants, and recreation for members and guests, such as tennis and swimming pool. No mention of golf, but it surely must be there as the Sea Ranch has everything else. The town of Sea Ranch is located on the Gualala River, which flows into the Pacific about a short one hour drive north of San Francisco. Bill says that he is many things to many people; Garbage Man, Fire and Police Chief, Mayor, plus being the General Manager of the whole caboodle. He says that the 25 cent decisions are just as tough as the 50 cent kind. Though Bill is our Vice President, I gather that he is too busy to assume too many responsibilities of that tough office. Before this article reaches the reading public, perhaps Bill will have been asked to cooperate, and we surely hope that he can find time, as he has been quite successful with Alumni Fund drives in the past, or so I hear.

We have a nice, short but sweet, letter from **J. Dyer Potter,** an old Connecticut man, Niantic. Dyer has been with the Connecticut Highway Department almost since its inception, but, he finally made the break and took time off; quite a lot of it. I take it that they flew to Hawaii, then stayed at several places on the Island of Oahu. Dyer called **Frank Der Yuen** by phone but did not get to see him. Frank, who is with Aloha Airlines, offered to fly him anywhere in the Islands, a fine offer but one that he could not see this way clear to accept, as he did not know Frank at all.

Now comes friend **Charles Britton,** with his photo for our 40th display. Charlie's note is short and very sweet, for sure short anyway. It seems that Charlie and Frannie are inveterate golf partners and really work at it. In addition to golfing, Frannie is a Hartford Garden Club enthusiast. The Brittons have three children; the eldest is a daughter, Anne, who is married to a Honeywell man. She is living in the Detroit area, and has three daughters. Son Skip (Charles, 3rd) works in Hartford at the United Bank, is married, and has one daughter. Golly, the daughters seem to have it with the Brittons; the youngest is also a daughter, whose name is Elizabeth, yclept Jill. Jill is apparently not married but working in Cambridge at the Harvard Business School as a Research Secretary.

To me our Alumni Day, now called Homecoming, is and always has been, a dignified, wholly pleasurable, informative, or, just plain dang well lovely day. Though this opinion may not be unanimously held, from what I hear it is almost so. This year was not different, except for the nomenclature, and, except that too few '33 folks made it. **Clarence Farr,** with his lovely, yours truly with mine, singly, **Bob Gammons, Ellis Littmann,** and **Clarence** (Westy) **Westaway.** So, we had two Vice Presidents and the Class Secretary. The story of the great day has already been told, so we will not linger. I do wish that some of the faithful would take the time to join us another year. Surely we are getting old enough.—**Warren J. Henderson,** Secretary, Fort Rock Farm, Drawer H, Exeter, N.H. 03833 (until November 12, 1969)

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It is a pleasure to start the notes for the new *Review* year with a report on our very successful 35th reunion. We moved off the mainland this time (but not very far off) to the Harborside Inn, Edgartown, Martha's Vineyard. The boat ride did not seem much of a deterrent as we had a fine turnout of 81 class members. All but six of them brought their wives.

Since arrival on the island depends on ferries, people came on Friday in clumps, rather than in dribs and dabs. Almost everyone was in by dinner and in the evening **Phil Kron** showed his collection of movies from past reunions. They're always fun but he's going to have to do some checking and rearranging of the records. We almost came to blows over which were from the 5th, 10th, and 15th and where they had been held.

Saturday was the full day and, despite a Cape Cod fog that varied from light to heavy, we all made good use of it. The golfers went thataway and a busload of others went on a sightseeing tour of the island. Still others walked around Edgartown looking at the lovely old houses and then drove on our own tours. Jane and I were among the last group and had Ruth and **Adrian Ross** and Winnie and **Ted Taylor** with us. When we got to Gay Head the fog gave us a choice: we could stand close enough to the lighthouse to see it, or close enough to the cliff to see the water 150 feet below, but not both at the same time.

On our way back around the island we passed an area where hundreds of gulls were nesting. In case any bird watchers in the class are interested, baby gulls look like brown puffballs—all covered with dark spots.

Saturday night, of course, was our big banquet and it was at the end of it that we encountered the innate perversity of inanimate objects (another formulation of Murphy's Law). **Paul Wing, Jr.,** our reunion chairman, had insisted on having the public address system set up and checked in the afternoon. Another check was made 15 minutes before it was to be used. Yes, you've guessed it. When **Johnny Hrones** came to the mike as M.C., it was completely dead. We tried all the standard electronic servicing techniques —plugging a light in the socket, checking the fuse, banging on the amplifier, but to no avail. So John moved out to the center of the room and did fine under his own steam. But one of the waiters was heard to say, "What do you know? All these M.I.T. graduates and they can't make the thing work."

The party ended Sunday with a brief business meeting. **Paul Wing** was elected class president and, as you will see below, you have a new class secretary. **Norm Krim** is getting a well deserved rest after the fine job he has done for us in the last five years. I'll report further on the other officers in future notes.

The reunion committee had made a special effort to invite widows of deceased class members to attend. We were particularly happy that **Sylvia Becker** (Mrs. Robert A. Becker) joined us and added to the good fellowship. . . . **Ed Chiswell,** his wife Lee, and their youngest daughter were our longest distance travellers. Ed managed to time a trip from London to San Francisco to put him on the East Coast at the right time. As mentioned in the March notes, he's in London for Chevron Oil and he told us his work was mostly in marketing assistance. It was a particular pleasure for me to see him as we worked together in the Musical Clubs' management in school. For those who may want it, his address in London is 44 Raynham, Norfold Crescent, London, W2, England.

Herb and Jean **Plass** were among those who brought a gift to be chanced off—a rubbing of a Thai brass that they got on a trip to the Far East. Herb is Professor of Internal Medicine and Voluntary Clinical Associate at the University of Minnesota Medical School. . . . After the reunion, **Frank Moore** was going to East Africa to check on more locomotives. This will make the second year in a row he's gone jaunting like this—promised a report on his return. . . . When we got back to the mainland, the Taylors came back to Brewster with us for a short visit. Since Ted's retirement from the Portsmouth Navy Yard they have spent a great deal of time abroad. They had brought some of their pictures with them and so we had a vicarious visit to the Canary Islands, the Mediterranean, and Switzerland. When they left for Kittery, it was for a summer of sailing and planning where they will be going this winter. The only cloud on their horizon (and it's a big one) is what the bulldozers will be doing to their land. A new bridge is being built to carry Interstate 95 over the Piscataqua River and the local approaches have taken a large chunk of their land. With its loss, most of Winnie's 20 years of gardening falls a victim of "progress."

Neal Karr has retired from the Singer Co. after achieving a vice-presidency. He is still living in Darien and, having a strong interest in M.I.T. and our Class, has agreed to help me with my "share-the-wealth" program on producing these notes. . . . **Joseph Bicknell** was promoted in July to full professor in the Department of Aeronautics and Astronautics. To my knowledge, he's the third member of our Class to achieve that rank in the department. The others, of course, are **Walt Wrigley** and **Walt McKay.**

Still close to the Institute, we can be happy to see the Class represented on the Corporation with **Harold Thayer**'s election to it. This is fine recognition of his many alumni activities, that includes membership on the Corporation Development Committee since 1965.

Professor **Victor Cole,** of the Department of Mechanical Engineering, University of Hartford has been elected president of the New England Graphics Association. Professor Cole received his M.S. at M.I.T. in 1934, following graduation from the Naval Academy in 1928. After an active wartime career, he was assistant naval attaché in London from 1948-1952 and then held various posts with the Bureau of Ships. Upon retirement—with the rank of captain—Professor Cole joined the University of Hartford in 1960.

Wilfred D. MacDonnell, president and chief administrative officer of Kelsey-Hayes Co., has been elected a trustee of the Cranbrook Institute of Science. This is the only science museum in the greater Detroit area. Last year he was also elected to membership in the National Academy of Engineering. . . . **Kenneth N. Scott,** formerly general manager of the Fisher Body division of General Motors, has been named a group vice president of the company's body and assembly divisions. . . . **Walter L. Wise,** president of the Henry G. Thompson Co., New Haven, Conn., has been elected to membership on the Executive Committee of the American Supply and Machinery Manufacturer's Association. Walt is also active with the Boy Scouts and is vice chairman of the Greater New Haven Chamber of Commerce.

John H. Holden has co-authored a paper on the role of wire size in negative electric discharges. This work relates to electrostatic precipitators and the report appeared in the *Transactions of the I.E.E.E. Industry and General Applications Group.* The work covered was done at Morgantown Coal Research, U.S. Bureau of Mines. John went there from West Virginia University in 1947.

As I mentioned earlier, there's been a change of watch for your secretary and this is all very new to me. But fortunately, all the men I saw at the reunion who had helped Norm in the past have agreed to continue lending a hand. As soon as I touch base with those who couldn't make the reunion, we will start listing all the names. But even six or seven men can't pull in the material to make these notes what they should be. A recent *Review* survey showed that class notes rated second (53.8 percent) as the most interesting feature of the magazine. If you want them to be more than summaries of news clippings, take an evening to tell me what's happening in your life. Some have been very faithful in the past. How about more in the future?—**Robert M. Franklin,** Secretary, Satucket Rd., Brewster, Mass. 02631

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Representing our Class at Alumni Day, June 16, were Bill and Mrs. Abramowitz, Rufus Applegarth, Leo Beckwith, Chester and Mrs. Bond, Ned Collins, Pete and Mrs. Grant, and Allan Mowatt.

In our mailbag was a letter from Bernie Nelson reporting the unfortunate passing of **K. G. Holdom** in May. He and Ken Finlayson attended the funeral.

The letter reported a dinner the previous January at Giovanni's in New York. The get-together was sparked by the arrival of **Carlos Lavenas** and his wife Mary who were in from Brazil. Larry Sharpe, who started in our Class but graduated in 1936, came down from New Hampshire, Lucy and **Ken Finlayson** from Westchester, and Elizabeth and **Walt Marshall** were in from Virginia. **Jeff Farmer** and **Zay Curtis** hoped to attend, but were tied up for business reasons. Harry Moore, Class of '32, and his wife, Maggie, came from Connecticut, and George Struck, Class of '34, flew in from Rochester to join the party, also, George arrived with camera in hand. He took many pictures as a remembrance of the occasion. The letter concludes with a promise that Bernie and Rhoda will attend the reunion in 1970.

An interesting letter from **Don Gittens** offers news of **Lew Simon, Gary Garaventa,** and **Paul Germond;** "I heard from Lew Simon just recently, and he appears to be happily engaged in government work at Point Mugu. I have seen him on a few occasions when his business activities brought him to the East. Likewise, I have occasionally run into Gary Garaventa, who still works for Hamilton Standard. Just as with yourself the last time, I saw him as he plunked himself down next to me on an airplane which we were both taking to London. You can imagine the surprise and animated conversation which took place all the way to Europe. The only other contact I have had recently has been with Paul Germond, who is still to be found plugging away at Revolvator Elevator Company, which, as you will remember, is his family's company and I guess at this point Paul must be carrying the entire load. I am looking forward to our reunion next year at Chatham and hope we will have the kind of turnout we had at our 25th reunion."

From **Winston A. Close:** "Lise (Elizabeth Schen, Arch.) and I were elected to the College of Fellows, American Institute of Architects; first husband and wife team to be elected at the same time." . . . Colonel **George G. Garton** reports: "Working as an administrator for General Motors management of the Main Battle Tank-70 Program at the Cleveland Army Tank-Automotive plant. Daughter finishing junior year at Stanford." . . . **John C. Alden** writes: "I am still with the Boston & Maine; have been a claim agent since July 1953. My son Peter has just had a book published by University of Arizona Press, *Finding the Birds in Western Mexico.* Son David graduated from the University of Maine, January 1969, in agricultural engineering."

P. Anthony Guarino says: "Am now Associate Technical Director of Army's Harry Diamond Laboratories in Washington, D.C. Am almost completely recovered from a mild heart attack last June (1968). My son and two daughters are all married (seven grandchildren)." . . . **Clyde K. Smith** writes: "Just completed 26 years with Bechtel Corporation (engineers and contractors) of San Francisco. Older of two sons now working as a physicist at the General Electric Laboratory, Schenectady." . . . **Prescott A. Smith** has been promoted to full professor in the mechanical engineering department at M.I.T.—Co-Secretaries: **Phoenix N. Dangel,** 329 Park St., West Roxbury, Mass. 02132; **Irving S. Banquer,** 20 Gordon Rd., Waban, Mass. 02168

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Alumni Day brought seven members of the Class back to Cambridge. At lunch I sat with Ken and Pauline Arnold and their son Robert, Bill and Sally Garth, Brent Lowe and Elliot Robinson. The Herb Bordens and Donaldson McMullins were in Rockwell Cage for dinner. Frank Parker was also on the list of attendees.

Milton Dobrin was nominated for President of the Society of Exploration Geophysicists, last spring; by now he must have been elected. He previously served the society as first Vice President in 1961-1962. In 1967, Milton became vice president-chief geophysicist of the United Geophysical Corporation, Pasadena (a subsidiary of Bendix) and during the spring was on leave to serve as William Stamps Farish Visiting Professor of Geophysics at the University of Texas in Austin. . . . **Albert Del Favero,** chief engineer at Oman Construction Company of Nashville, Tenn., has been named consultant for real estate acquisition and construction for American Child Centers, Inc., which is planning a nationwide chain of day care centers. He is also Executive Vice President of Compumedics Sciences, Inc., newly organized for computer applications in the medical field. . . . **Larry Kanters** was elected Corporate Vice President for Department Stores of Gamble-Skogmo, Inc. He joined the Gamble's organization last April having previously been a divisional merchandise manager for Kaufmann's of Pittsburgh. . . . **Brockway McMillan** was elected to the National Academy of Engineering last May and was named a Vice President of Bell Telephone Laboratories with responsibility for Military Development.

At least two classmates have been in print recently: **Ariel Thomas** with a paper presented last December before the Sanitary Section of the Boston Society of Civil Engineers, *Proposed Alcosan Secondary Treatment;* and **Bernard Vonnegut** with a book review in the *I.E.E.E. Spectrum* last April. . . . The *Hartford Courant* of August 10, announced a Senior Girl Scout Conference, "Our Future—Waste or Wealth." The program included field trips and workshops on air, land and water conservation. **Louis Proulx,** chief of the air pollution control section of the Connecticut's state health department was one of the guest speakers.

While your Secretary's permanent address is P.O. Box 31, West Hartland, Conn. 06091, mail will reach me during the coming winter at the address below. I'll look forward to hearing from you.—**Alice H. Kimball,** Secretary, 221 Lake View Ave., Cambridge, Mass. 02138

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This being the first issue after a hot, humid and wet summer, there is a lot of news to be reported. There were only a few of us at Alumni Day. In addition to your secretary, John Glacken, Bob Johnson, Don Severance and Harold McCrensky attended. Suggestion: Why not count on attending next year's Alumni Day?

Al Wagner reports that he is working as a service engineer in commercial publications (maintenance) with the Boeing Company and living in Reuton, Washington. His daughter will be in Germany this summer with a University of Washington Group and plans to go into the Foreign Service. . . . **Boris W. Boguslavsky** writes that he retired as a Civil Engineer from the Arabian American Oil Co. in Dhahran, Saudi Arabia, in September 1968, returned to the U.S. as a visiting professor of civil engineering at the Virginia Polytechnic Institute (1968-1969), and became professor of engineering graphics at the Louisiana State University in September 1969.

Vincent Salmon, senior research scientist of the Stanford Research Institute, is the new president-elect of the Acoustical Society of America. . . . **Charles J. Donlan** played an important role in the Apollo 11 lunar landing mission as a deputy associate administrator for manned space flight in N.A.S.A.'s Office of Manned Space Flight in Washington. This office is responsible for the planning, direction, execution and evaluation of N.A.S.A.'s overall manned space flight program. . . . **Howard E. Milius** was elected vice president-corporate planning and commercial development at Millmaster Onyx Corporation. . . . **Frank Kemp,** senior vice president-media programing director, Compton Advertising, has joined John F. Murray Advertising, the American Home Products house agency, as senior vice president-media director, a new post. Frank had been with Compton for about 26 years. Compton was an American Home agency until early 1968, when it resigned more than $3,000,000 in Boyle-Midway division billings.

Paul R. Desjardins has been appointed manager of operations in the newly formed Worthington Machinery Systems International which markets, coordinates, engineers and builds systems, subsystems and turnkey installations around the world, all based on Worthington components. These installations include air and gas compression, pumping, industrial and marine refrigeration and power plants utilizing diesel engines, gas and steam turbines. Paul joined Worthington in 1938, and most recently was Director of Worthington Corporation Research and Development Planning. He resides with his family at 12 Surrey Lane,

Francis W. Sargent, '39 (right), Governor of the Commonwealth of Massachusetts, received a warm welcome at Rockwell Cage on Alumni Day. Participating in the welcome were President Howard Johnson (left) and fellow governor Luis A. Ferré, '24, of Puerto Rico.

Madison, N.J. . . . **Paul Black** writes that he spent a very pleasant day with **Welcome Bender** a few weeks ago at the Martin Marietta plant near Denver. Welcome is now Program Scientist, Planetary Systems and has lost none of his energy and enthusiasm; he has also become a devotee of outdoor living—Colorado style.

Earl Macleod was named manager of consumer product planning, Carrier Air Conditioning Co. Earl joined Carrier in 1945. He has been a development engineer and project supervisor on a variety of consumer and commercial products, and was room air conditioner development manager prior to his present appointment. He holds 19 patents, and is the author of several published articles.

Your Secretary has been transferred from Newark to the National Headquarters Office in New York; note the new address.—**A. L. Bruneau, Jr.,** Secretary, Hurdman and Cranstoun, Penney & Co., 140 Broadway, New York, N.Y. 10005

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Thirtieth reunion notes will hopefully be ready for the next issue, but in the meantime here is quite an accumulation of notes from a variety of classmates. Heading the list is **Frank Sargent,** Governor of Massachusetts, one of the featured speakers at the Alumni Day Luncheon. Following Frank's excellent remarks, it was **Ernie Kaswell**'s privilege to present a silver stein from the Class of 1939 to our distinguished classmate.

I had the pleasure of bumping into **George Beesley,** recently appointed Vice President of Harold A. McCrensky & Associates, a Boston management firm, on a Friday afternoon plane from Columbus to Pittsburgh, in May, and was posted on his activities as a consultant to companies and divisions badly in need of turning around in their manufacturing, sales, and personnel activities.

Donald and Mabel **Leslie,** Course X, will be living in Kurashiki, Japan, for a year or more beginning in October while Don consults with Asahi Chemical Industry, Ltd. on an ammonia plant. He is Senior Project Engineer for C. F. Braun & Company. Two years in Holland and a year in Australia are also among Don's recent travel experiences. . . . **Roger W. Swartz,** Course VI, wrote that he recently retired as Chief, Radio Engineering Section of the Laboratory of Federal Bureau of Investigation. Rog is going into private industry. . . . **Wilbur D. Vincent,** Course VI-A, noted that his last job change occurred in January, 1968, when he was appointed Manager of Engineering, Speed Variator Department, one of G.E.'s core growth businesses.

Lloyd P. Hunter, in a letter postmarked in May from California, wrote that he had spent the past academic year on leave from the University of Rochester at I.B.M.'s Research Lab in San Jose, and that he was returning to New York by way of Marfa, Texas and the national soaring championships. . . . **Ernest O. Ohsol,** Course X, wrote that he is now with American Cyanamid's Stamford (Connecticut) Research Center, getting back into scientific activities. His younger son is in the infantry in South Vietnam, and he now has two grandchildren. . . . **Robert C. Casselman,** Course XV, along with his classmate-boss Governor Sargent, has been making the newspapers. Bob is executive secretary of the Governor's Advisory Committee on Modernization, and as such is chief architect and spokesman for the modernization plan for Massachusetts state government. It would bring over 300 state agencies under a streamlined administrative operation. Bob has been in demand for meetings around the state, explaining the proposed program. . . . **Leonard D. Jaffe,** Courses XIV and XIX, authored an excellent article in the 16 May 1969 issue of *Science,* "The Surveyor Lunar Landings." Thirteen pages of very readable (for laymen) text and photos.

There is one death to report: **Edwards R. Fish, Jr.,** Course XV, of 17050 Northrup Way, Bellevue, Washington, 98004. Our sympathy is extended to his widow, Harriet. He was listed in the 1967 Alumni Register as being Controller and Secretary of Milliman & Robertson, Seattle, Washington.—**Oswald Stewart,** Secretary, 3395 Green Meadow Circle, Bethlehem, Pa. 18017

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As a result of *not* having a class notes column in the July *Technology Review,* several newsworthy letters were received. This will encourage your Secretary to be less conscientious in the future in the hope of receiving more letters. From **Edgar Bernard** comes the following: "I noted in the July issue of the *Technology Review* that our Class was not mentioned. Apparently you had been furnished no material for insertion. I have experienced vicarious pleasure from the reported experiences and successes of my classmates in the "Class Review" section and so thought it was my turn to give you some filler material.

"Historically—immediately after leaving M.I.T., I joined Reynolds Metals Co., Richmond, Va., as Thermal Engineer. Then spent five years with the U.S. Army Corps of Engineers with my service culminating as Engineer Operations Officer on General Patton's Staff for five campaigns. After release from the Army, rejoined Reynolds Metals Co., at Louisville, Ky., as Assistant Chief Engineer and Chief of Research & Development, Refrigeration Division. With Reynolds support and assistance, I returned to Boston as Chief Engineer of Clark-Babbit Industries. This was indeed a most productive and fruitful experience with 17 plants in all phases and types of manufacturing. When the Company decided to reduce the scope of their activity, I moved over into Sales and joined S. Lemberger, Inc., a sales agency. Over the years, sales were increased from a few hundred thousand to a few million dollars annually and I became President and Director of of the firm. In 1952 I formed this company (Berbeck Co.) which has been operating concurrently with my other activities.

"Two months ago, I agreed to sell my holdings in S. Lemberger, Inc., and resigned as President and Director. I have been retained as a consultant on a very long term contract. While I have been continuing my activities with Berbeck Co., I have been enjoying some rest and relaxation and have been doing some serious investigation and introspection prior to entering a new line of major activity. It is my intent to channel my energies

and activities over the next 10 to 15 years into a field where meaningful, productive service can be realized."

Bruce Duffett's letter was a literal goldmine. "In glancing thru the last issue of *Technology Review* class notes it was disappointing to see no mention of the Class of 1940, but on further thought it occurred that I was as much at fault as any one since I have never been an active contributor to your column. It has been a pleasure to be Class Agent this year and it has provided me the opportunity to write to about 40% of our Class who generously contributed to the Alumni Fund. More members of our Class contributed more money than in any previous year. It has also been pleasant to correspond with or visit personally several members of our Class.

"**Bob Goodwillie** in Kennett Square, Pa., wrote of some of the problems facing all of us today. He has two children in college now, one at Knox and one at Baldwin-Wallace. He shares concern in the racial problems confronting college administrators. He questions the advisability of sending large numbers of our youth to college where they have little or no desire to learn. His comments regarding inflation and irresponsibility of government officials in many of today's problems reflect some deep thinking and concern for the future.

"**Bill Morrison** has a lovely home in Winston-Salem, N.C., and is president of a fascinating small company called Medical Plastics Corporation of America in Greensboro. Their product, Medi-Gard, incorporates an anti-bacterial agent which destroys many bacteria normally associated with hospitals. Their sheets, pillow-slips, drapes, matress-covers, table tops and molded hospital-ware are very effective in reducing the spread of infection within hospitals. His son, Lee, is a senior in high school and looking forward eagerly to college.

"**Dick Braunlich** writes from his home in Westchester, Pa., that he has two sons in college. Mark at the University of Pennsylvania is carving a name for himself on the wrestling team and has a record as an outstanding athlete. As I recall Dick was quite a tennis player on the Walker Memorial Courts. He also mentioned bending an elbow occasionally with Bob Grosselfinger. Dick is now Director of Research in Marcus Hook at the American Viscose Corp., Division of FMC.

"**Frank Penn,** who is more familiar with Panama and South America than with his homestead in Connecticut, has changed his New York office to 1345 Avenue of the Americas. He serves as assistant to the president of National Bulk Carriers, Inc. His interest in orange groves and orange juice concentrates has expanded into other areas.

"**Bill Kather** regularly attends the meetings of the Commercial Chemical Development Association. He lives with his wife Peggy and is associated with the James Hynes Company, Management Consultants, on South LaSalle St., Chicago. Bill's two daughters Joan and Diane are both married and he has several grandchildren. His present position involves some exciting new product developments.

"**Russ Werby** attended the spring meeting of the American Chemical Society in Minneapolis and renewed an old friendship after 29 years. We had a good dinner together after which he produced some giant cigars. He is chief executive and principal officer of a Boston based testing laboratory which has been serving industry for many years. He has been very active in A.C.S. affairs, having served as president of the New England section.

"**Joe Wiley** put in an appearance at the American Electroplating Society Show and the N.F.P.A. exhibits at Cobo Hall, Detroit in June. He was dressed in a straw hat, and dapper red and white striped jacket reminiscent of a circus barker pointing out the strong points of Serfil filters for plating solutions. His full head of white hair accents a handsome youthful appearance. We enjoyed a couple of drinks together to celebrate the chance of meeting.

"**Bob Davis** has a new home address in New York City. He travels all over the world as Vice President and General Manager of the Hooker International Division.

"**Charlie Freeman** now resides in Malibu, along the coast northwest of Los Angeles. He has an office with a commanding view of Los Angeles on the tenth floor of 550 South Vermont Ave., in a beautiful new high rise office building. His principal interest is with MFB Mutual Insurance Company although he has many irons in the fire, as usual. You may recall that Charlie spent many years in Nassau, Bahamas, as owner and manager of the Royal Victoria Hotel. One of his current interests is working with **Al Barton** in a company called Pool-Mates Inc. marketing a line of swimming pool accessories. His many activities and accomplishments through the years should be collected in a book as they make a fascinating story.

"My travels for Marbon Division, Borg-Warner Corp., happily provide the opportunity to meet some of our classmates in various parts of the country. As Manager of Commercial Development, I get involved in new applications for Cycolac ABS Plastics, electroplated plastics, new chemicals including an odor oxidant, called Purafil, which can destroy odors and gaseous pollutants. This is a particularly exciting new development with a great future in improving the quality of air in public spaces and industrial problem areas. It is very specific to most obnoxious odors and to contaminants such as hydrogen sulfide, sulfur dioxide and formaldehyde. I live with my wife in Marietta, Ohio, where we play tennis as often as time permits. Our oldest daughter graduated from Wellesley and is married to a young doctor from Harvard and Tufts College. A second daughter graduated this year from Hanover College, Indiana. A son is an undergraduate at Princeton with the last daughter a senior at George School in Pennsylvania. Sometimes I think we are working to support the educational institutions.

Secretary reports that he took his longest vacation in several years in June—two weeks. Had his gall bladder removed and then relaxed at home. Everything is fine now and he is traveling far and wide and playing *at* golf again.—**Alvin Guttag,** Secretary, Cushman, Darby & Cushman, 730—15th St., N.W., Washington, D.C. 20005

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Among those attending one or more of the Alumni Day activities on June 16, 1969 were Edward R. Marden, Irving Stein, Walter J. Kreske, Mr. and Mrs. Donald McDonald, and Harvey I. Pofcher with his son.

Carl M. Mueller has been elected a member of the M.I.T. Corporation for a five-year term, effective July 1, 1969. He has been a vice president of the Alumni Association for the past year and has been active in alumni affairs and as a member of Corporation visiting committees. He is a partner of Loeb, Rhodes & Co., a director of Applied Devices Corporation, Cabot Corporation, Capitol Industries, Cramer Electronics and Federated Mortgage Investors. He is chairman of the Expansion Fund Committee of the Valley Hospital in Ridgewood, N.J., and is former vice chairman of the Ridgewood Planning Board.

Those of you who may think ill of the Post Office Department for alleged failures in expected mail delivery may admit the fault to be your own if you read the page 18, July 25, 1969 *Washington Post* report of the experiences of our classmates Charles and **Edith Corliss.** The report is as follows: "Edith L. R. Corliss of 2955 Albemarle Street, N.W., Washington, D.C., was recently sent a subscription circular by the *Scientific American,* which must buy its mailing lists from the same store that sells hats to Boston dowagers. The circular was addressed to 'Miss Edith L. Rovner, Mass. Institute of Tech., Cambridge, Mass." Miss Rovner was graduated in 1941 and Married Charles Corliss in 1943. Despite all this, the Post Office Department delivered her circular to her Washington address without delay. And when she and her husband were living in England, British postal workers delivered to them a water bill from the District Government addressed with impressive simplicity to: 'Mr. Charles H. Corliss, London, England.' " One must admit, it's mighty hard to fault that kind of postal service. . . . **Mitchell J. Marcus** has been elected to a three-year term as an alternate member of the Board of Governors of the Technion, Israel's Institute of Technology lo-

cated in Haifa. Mitch is president of the Boston chapter of the American Technion Society and a director of the National Technion Society. He is also president of Production Systems, Inc. of Waltham, Mass.

Sam Goldblith who is Deputy Head of Tech's nutrition and food science department received the 1969 Babcock-Hart Award, an engraved plaque and a $1,000 honorarium, sponsored by the Nutrition Foundation, Inc. Sam earned the award for his research work, application and education in advancing the nutritional excellence of foods subjected to processing especially by radiation or freeze drying as well as microwave heating.

John Fonseca has been promoted to the position of general manager, Radiarc Inc., Monterey Park, Calif. In his new position he is responsible for distribution and business development planning for the firm's line of electro-optical instruments, Xenon and mercury arc lamps. John joined Radiarc as sales manager two years ago.

Richard H. Engelman has been placed in charge of the Manufacturing Facilities Section of the Cost Engineering Department of Procter and Gamble's Engineering Division. He was formerly head of the International Construction Section of that company. . . . **Lewis T. Jester, Jr.,** now has a son at M.I.T. . . . **Walter P. Keith, Jr.,** has been president of the Hygienic Dental Mfg,. Co. since 1968. The company manufactures expendible dental and medical products. . . . **Donald McDonald** has been with Electronics Corporation of America, Memorial Drive, Cambridge, Mass., since July 1967 and presently resides at 62 Mill St., Sherborn, Mass. . . . **Robert W. Blake, Jr.,** reports that he has no complaints at this time and still lives in Falls Church, Va.

Calvin D. MacCracken reports: "My 75th U.S. patent has just been granted on the 'Air-Freeze' Skating Rink. It is pipeless, works by stratified cold air like a giant supermarket food freezer case. Two full size rinks are in operation and my new company, Recreational Facilities Inc., is busy with new orders because of lower cost and better ice." . . . **Joseph G. Gavin, Jr.,** vice president of Grumman Engineering Corp., and formerly director of its Apollo Lunar Module Program, has been appointed director of space programs. He was previously chief missile and space engineer and directed the winning design and proposal effort for the lunar module. . . . **Loren E. Brunner,** retired U.S. Coast Guard officer and specialist in precision electronic navigation systems, was promoted to Full Professor of Electrical Engineering Technology at Purdue University. Last spring he was selected by students and faculty as the Outstanding Undergraduate Teacher at Purdue's Calumet campus. He joined the faculty in 1964 as associate professor after a 30-year career in the Coast Guard, where he was instrumental in development and installation of electronic navigation systems throughout the world. —**Walter J. Kreske,** Secretary, 53 State St., Boston, Mass. 02109; **Everett R. Ackerson,** Assistant Secretary, 831 Cranford Ave., Westfield, N.J. 07090; **Michael Driscoll,** Assistant Secretary, 63 Center St., Nantucket, Mass. 02554

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Luther Davis, Jr., has been promoted to general manager of Raytheon Company's Research Division. He has been with the Raytheon Research Division since 1949 working on and directing research programs particularly in the fields of semiconductors and ferrites. . . . **Dick Gannon** has been elected a trustee of the Westboro Savings Bank. Dick is President of Gannon Motors in Westboro. . . . **Wen-Mou Chow** writes that he became Professor of Quantitative Methods at Fullerton College in Fullerton, Calif., in September. . . . **Antonio Kayanan** has been on a United Nations Technical Mission in Peru. While there he reports that he learned much about the remarkable skills of a pre-Columbian people in the planning engineering and building of Machu Picchu, the Lost City of the Incas, High up in the Andes.

From La Jolla, Calif., we hear that **Dave Lambert** has retired from the Navy as a Rear Admiral and is setting up shop as a technical consultant. . . . **Bernie Levere**'s annual message tells that he is presently constructing several buildings on the upper West Side of Manhattan. His eldest daughter has finished her freshman year at Smith. Bernie's son is spending the summer on a World Youth Forum trip in Europe. . . . **Al Waggoner,** formerly director of management operations and technical support at Airborne Instruments Laboratory has been named a company vice president. . . . **P. M. Ku** has been installed as the 25th president of the American Society of Lubrication Engineers. He is currently director of aerospace propulsion research of Southwest Research Institute in San Antonio.

A short biography from **Vic Frank:** ". . . Worked on synthetic rubber for Dewey and Almy from 1942 to 1946. Entered grad school in March 1946. Joined Merck and Company in 1949 and worked on cortisone. Rejoined Dewey and Almy in Cambridge in 1951. Research Manager of Organic Chemical Division from 1955 to 1962. Have been at W. R. Grace Research Division in Clarksville, Maryland since 1962. Since October 1968 have been Research Division vice president."

Clinton D. Cook, vice president for academic affairs of the University of Vermont died on June 25 after a short illness. He had been at Vermont since 1952 and was named a vice president in 1965. Mr. Cook was responsible for many innovations there including the creation of the Division of Health Sciences and strengthening and expanding the graduate programs with the addition of Ph.D. curriculum in ten different fields. We extend sympathy to his wife and family.—**Ken Rosett,** Secretary, 191 Albemarle Rd., White Plains, N.Y. 10605

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A not-so-brilliant thought that has occurred to me recently is that we might start publishing some of the correspondence between Dick Feingold, the *real* Class Secretary and yours truly, the *back-up man.* In the July/August *Review,* Dick made it sound as if we two secretaries coordinate our efforts in a manner as effortless and accurate as an IBM 360 grinding out the executive payroll each month! Brethren—'taint so. Actually, I'm always wondering, "Let's see—is it Dick's turn—or mine?" [I wonder too. Would like schedule.—Ed.] In a recent letter exchange with my "leader," he graciously ended with the dictated sentence: "Kelly—you're doing a great job for a rookie." Thinking better of it as he picked up his pen to sign the message, he added, "How to alienate an Associate Secretary." "Don't worry, Dick . . . as long as I can operate on the write-as-you-go system, I'll keep at it in spite of your insults!", so said I. Now, there you have it—pretty dull stuff listening to tid bits from your secretaries' internal correspondence! This should stimulate something that's livelier. I hope some of you will activate that pen or typewriter this year. I may have to start writing *directly* to your wives and children for news. That approach has worked wonders for generating interest in our company's social events! Perhaps we could even ask for contributions from the grandchildren of '43 as they come of literary age. Let's hear from some of you grand-dads; we had a few at our 25th reunion in 1968. Any new ones—or repeats—since then? Not me! Yet. . . .

Thanks for the "notes on my activities" scribbled on the envelope that accompanies Alumni Fund mailings. Three such messages have been deciphered. **George W.** (Bill) **Potts** is now General Manager of Esso Standard Eastern's Philippines Division, domiciled in Manila. On the family score-card, Bill reports two grandchildren living in Rio de Janeiro; one daughter graduating from Tufts and another from Dana Hall this year—that may be past-tense by now. A son is in high school. On behalf of Esso Eastern (also my employer) and himself—he says "C'mon out 'n see me sometime. . . ."

Thomas M. Bennett writes from Fanwood, N.J. to say, "Remarried after being widowed for five years . . . to the former Kathleen Berning. Thereby acquired one more son making a family of four sons and two daughters. We are looking forward to one daughter-in-law sometime in 1969-1970. Two sons in engineering schools (Villanova and Newark College of Engineering) . . . one daughter in philosophy . . . Dad in the poorhouse!" Thanks, Tom, and call in some more news soon!

Gilbert M. Edelman made the crisp announcement, "Have joined Martin-

Marietta, Orlando Division, Director of Technology Programs."

"The Application of Technology to Education" is the title of a report published by the American Society of Engineering Education last spring; the publication reported on a symposium on this topic held in September, 1968. One contributor to the section on Managing Change was **Augustin A. Root** who is at the Center for Instruction Communications, Syracuse University. His paper was titled, "A Proposal for Innovations in Undergraduate Engineering."

John Hummer, most recently director of a graduate engineering education project in Florida, will become dean of the University of Portland's new Multnomah School of Engineering. That's what is known as "promotion on the diagonal"—Florida to Oregon! . . . **Sid Siegel** has been elected president and chief executive officer of Technical Metals, Inc., of Avon. Before coming to Technical Metals, Siegel was president of Boston-based U.N.A. Corp., formerly U.N. Alloy Steel Corporation. . . . The clipping service just relayed a batch of news tid-bits but the editor's call for "deadline on August 12" precludes my pouring over them for this issue. See you next time.—**A. J. Kelly,** Assistant Secretary, 34 Scudder Rd., Westfield, N.J. 07090; **Richard M. Feingold,** Secretary, 266 Pearl St., Hartford, Conn. 06103

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The 25th Reunion was a tremendous success thanks to the fine work of Burt Bromfield and his committee. The wives seemed to enjoy the activities as much as the grads and the children were well supervised separately, to provide a relaxed vacation for all. Some of the youngsters learned the essentials of dorm life very quickly, holding a floor-wide pillow fight at 6 a.m. the second day. Typical photographs of the events were published in the July/August *Review* on page 125.

On Saturday we had an opportunity to hear some of the exploits of one of our own classmates. **Jim Mavor** gave an illustrated talk on his explorations of Greek islands. His talk, "Voyage to Atlantis," was a fine mixture of archeology and humor with an indication of some of the political problems encountered during these diggs. All in all, the 100 classmates, plus wives and children, had a marvellous time. The standard farewell statement was, "See you at the 30th."

One of the highlights of Homecoming, June 16, was the announcement of the class gift of $525,768. As Norm Sebell noted, this was the second largest 25-year gift in M.I.T. history, a fitting memorial to the hard work of Bob Faurot before his untimely death. The other major business item was the election of officers for the next five years; **John Hull** agreed to serve again as President; **Burt Bromfield** and **Paul Heilman** became Vice Presidents; **Paul Robinson** moved from Secretary to Treasurer and **John Barmby** took over Paul's old job; **Norm Sebell** will continue as Class Agent while **Peter Quattrochi** assumes the position of Alumni Advisory Council Class Representative.

The formal dinners and dances were delightful supplements to the informal reception at President Howard Johnson's residence, the clambake, and bull sessions. Everyone referred to the "Red Book" (Stan Warshaw's labor of love summarizing the biographies of most classmates) to refresh memories of old friends.

The dinner addresses by President Johnson, and Governors Sargent and Ferré complemented the discussions led by Professor Rosenblith and Dean Wadleigh earlier in the Homecoming program (*see* Technology Review *for July/August, 1969, pp. 121-124*). The Governors stressed their need for M.I.T. alumni while the professors described some of the internal problems faced by the Institute with the current generation of students. A "lab course" on student unrest was given Monday by representatives of dissident student groups and others who chose to demonstrate on Homecoming rather than on Graduation Day, the preceding Friday. The dissidents, complete with bull horn, harangued groups outside and inside Kresge Auditorium. Some of the Class gave them lucid explanations of alumni "relevance." In fact, **Sten Hammarstrom** gave such a notable reply that he was featured that night on the local TV news. The situation was well-disciplined and we got the impression that President Johnson and Dean Wadleigh were professionals in handling confrontations.

We have clippings concerning the advancements of our classmates and a few changes of addresses. However, I'll save them until next issue to give you all time to send in other news items. A lot of you come through Washington so give me a call at 202 296-1610 or drop a note.—**John G. Barmby,** Secretary, IIT Research Institute, 1825 K St. NW, Washington, D.C. 20006

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Attend Your 25th Reunion
June 12-15, 1970
M.I.T. Campus

This is the year. Start your planning today for the gathering of the clan is just around the corner.

We all know that our able Reunion Committee will provide us—and our families—with an excellent program. What is not generally known at the moment is that the Alumni Day or Homecoming Committee is taking a new, different, and most exciting approach to Alumni Weekend. You have my assurance that you will have a far more entertaining and enlightening experience than you can possibly envision.

Bob Maglathlin, your *25 Year Book* editor, has asked that I ask you to make certain you have returned the questionnaire forwarded in early July. If you have misplaced this item drop me or Bill Meade a line. Bill lives at 83 Edgewater Drive, Quincy, Mass. 02169.

Congratulations to **Jeptha H. Wade, 3d,** upon his June election to the Corporation of M.I.T. for a five-year term commencing July 1, 1969. Jeptha's election is not only an honor for himself but for the Class as well. He is a member of the Corporation of the Boston Museum of Science and a trustee of the Museum of Fine Arts, Boston, the Children's Museum of Boston, the Massachusetts General Hospital, Children's Hospital and Case-Western Reserve Historical Society. He is a member of the M.I.T. Corporation Development Committee and was the first chairman of the Massachusetts Council on the Arts and Humanities. Need we add that his wife, the former Emily Vanderbilt, is a fellow classmate.

Raybestos in Stratford, Conn., announced last spring the promotion of **Arthur J. LaCroix, Jr.,** to Assistant Director of Research and Development. Most recently Art, a fourteen-year veteran of Raybestos, has been chief engineer of friction materials. . . . A recent news release in conjunction with Apollo 11, indicates that **Richard M. Poorman** is an aerospace engineer at N.A.S.A.'s Marshall Space Flight Center, Huntsville, Ala. . . . **Art Dupuis** has joined Dow Badische Co., as chemicals market development manager in Williamsburg, Va. . . . **Daniel G. Meckley, 3d,** of York, Pa., has been elected President of Unitec Industries. Prior to joining Unitec, Dan was corporate Vice President, Director and member of the Executive Committee of The Tappan Company. Before that he was with the York Division of Borg-Warner. . . . **Ed Stoltz, Jr.,** reports that he thoroughly enjoyed Management in The Seventies, a seminar sponsored by the Alumni Center here in New York last spring. . . . A recent address change indicates that the **Jim Hoaglund**s have joined the Stoltzes in Princeton, N.J. . . . **Stephen E. Eppner,** Vice President of the M.I.T. Alumni of Long Island, is Plant Manager at Gem Electric Mfg. Co., Hauppauge, Long Island. . . . While in Europe last summer, **Tom McNamara** spent some time with **Alan G. Mencher,** Scientific Attaché at the U.S. Embassy in London.

Those in attendance Alumni Day were: Bob and Ann Maglathlin, Warren Miller, Class Agent Jerry and Mary Quinnan, Bill and Elaine Schuman, John Morrison of Stratford, Conn., with two prospective students as guests, Warren Smalzel, Prexy Tom Hewson and yours truly. I particularly enjoyed reminiscing with the '44ers in attendance. Where are *your news* items?—**C. H. Springer,** Secretary, MFB Mutual Insurance Company, 420 Lexington Ave., New York, N.Y. 10017

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The past 60 days has brought a fine num-

ber of letters and notes from classmates. We have received three letters directly and have been given several notes written on the flap of Alumni Fund contribution envelopes. Mentioning the Alumni Fund permits me to remind all of you that 1971 is the year of our 25th reunion and that we have a long way yet to go to meet our goal for the 25th reunion gift to the Institute. Please send in your contributions or pledges and include a few brief notes for me.

Louis B. Wadel attended the Graduate School of the University of California after graduation from M.I.T. in 1946 and then spent a year in airborne computer design at Norden Laboratories, White Plains, N.Y. Joining Chance Vought Aircraft in Dallas, he worked on computers, automatic flight control and missile guidance. It was also in Dallas that Louis married Carol Hirsh in 1950. The Wadel family has since grown to include two daughters. In 1963 Louis founded and since has served as President of Logic, Inc., of Dallas, an electronic computer consulting firm, which, while Dallas based, operates nationally.

E. Fulton (Bud) **Brylawski** has written a very nice letter and report on his activities during the past 20 odd years. After graduation Bud obtained his M.B.A. at Harvard Business School and an L.L.B. at Yale Law School. Before settling down to the practice of law in Washington, D.C., he married his lovely wife, Laura Carizzoni, whom he met in Italy in 1953. Those of you who attended the 15th reunion at Snow Inn will recall the delightful Laura who, with Bob Fried's lovely wife, painted the Cape Cod scenery from the docks near the Inn. The Brylawskis have three children, Debbie (13), Brandy (9) and Bret (6). Bud has involved himself in community endeavors, highlighted by membership on the Board of the County Federal Savings & Loan Association, Beavoir School, The Washington Theatre Club and P.A.A.C., the last a pro-black anti-crime organization with lofty aims and no money, but working hard to solve the problems of the inner-city.

John L. Norton, Jr., has been transferred to the General Electric Jet Engine Technical Division at Evendale, Ohio, a city near Cincinnati. John reports he and **Guy Wooten** are working together on the F100/F400 jet engines for the U.S.A.F./U.S.N.'s newest fighters. Before moving to 11997 Cedarcreek Drive in Cincinnati, John was with the G.E. Missile and Space division at Cape Kennedy. He and his family lived there for seven years (and 67 missile launches). John and his wife, Priscilla, have a daughter, Linda, who has completed her third year at the University of Florida, and a son, John, who is completing his freshman year at Yale.

John A. Gautraud is working for United Aircraft in Windsor Locks, Conn., as the General Manager, Electronic Systems, of the Hamilton Standard Division. John, his wife, Stephanie, and children, Nanette 17, John 12 and Nicole 11 live in Avon, Connecticut.

We received a short note from **Fred V. Fuller** dated June 12, 1969, and postmarked Chicago, Ill. Fred recently met Bill Lang, '49, for the first time in twenty-three years while they were both on the same flight to London; Bill was aft at the galley negotiating for another drink. Fred reports Bill is now a Ph.D. and is in research at I.B.M.

Harold Jacobson has been made technical director of the Poseidon program of Raytheon's Space & Information Systems Division, Sudbury, Mass. . . . **Frank T. Westcott** has won the Open Pairs Championship in Bridge at Plymouth, Mass., with his partner, Steve Ekblad. Not only does Frank have more Master Points than any other player in New England, but he also has more accolades on his record for working for bridge and advancing the game throughout the country. . . . **H. F. Goelzer** has been elected vice president of the Marquardt Corp. He also serves as president of the Marquardt Industrial Products Co., whose products consist of railroad transportation items and electronics control devices for the transportation industry. . . . **Frank E. Cotton, Jr.,** head of the Department of Industrial Engineering at Mississippi State University has been elected executive vice president of the American Institute of Industrial Engineers.

Only three members of the Class, David Black, James Craig and Clarence S. Lyon attended Alumni Day June 16, 1969. I would think that with so many class members in the Boston area that more than these three fine men would have taken the time to attend this important function. **—Russ Dostal,** Secretary, 18837 Palm Circle, Fairview, Ohio 44126

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We are just back from a very pleasant week of sailing on a friend's 34' Tartan through the islands of western Lake Erie. Gina and I still prefer the ocean but the children, having their first real experience of sailing, thought everything just perfect. In the pile of mail that is always present at the end of a vacation I find that these notes are due and that I missed the July/August issue. My apologies for the latter and will try to see that it doesn't happen again. The former is made considerably easier and more pleasant by the receipt of several letters and notes. It also shows that I am starting to get through to my classmates.

Gil Parker writes: "It was a pleasure to realize that I am still remembered at M.I.T. As usual, the first page I turn to when I read *Technology Review* is the news of our Class. I was startled to see my name appearing there and must apologize for not having taken the time to keep in touch with you. It's true, we have recently moved to a wild, contemporary home on the side of a mountain, overlooking a lake in Suffern. By "we" I mean my wife of four years and my 5-month-old son. It must be obvious that being a bachelor appealed to me for quite a while. It is also true that I am still with I.B.M.—since 1961 with the international division, The World Trade Corporation. I had all sorts of jobs in the planning and forecasting areas and just recently, as head of the DP Data Planning Department, was given the responsibility of developing our Manage-Information System. I am sorry that I missed you at our 20th year class reunion; I hope to do better at our 25th. My regards to you, your family, and all of our classmates. Thanks again for remembering me."

Ed Kane sends us this bit of news: "Your pleas for letters have not fallen on deaf ears; many times the urge has siezed me, but this time I had a pencil! I would like to compliment you on an excellent job of keeping us up-to-date on our Class. Last weekend Jackie and I attended the 35th William H. Carlisle Assembly Ball. It was a very pleasant experience, despite a torrential rain (fortunately the tails were rented); **Harl Aldrich** and his wife were there. It was at Walker Memorial that I met Jackie, when the T.C.A. brought a load over from Simmons during 1945. She graduated in 1949, and we were married. The visit gave our two children, Jimmy 14, and Patti Anne 11, a chance to see the Red Sox beat Cleveland—and join in on the chanting for 'The Hawk.' At Combustion, I am now Manager of Commercial Development in the Utility Division. This is mostly concerned with broadening our Divisional base through acquisitions, although I am also involved in expanding our markets through internal development. A while back I headed up an International Desalination Program that allowed me to visit with the **Arnold Judson**s in London, although we have not been able to get together now that he is in Cambridge. **Jack DiSavino** stops in to visit occasionally, either before, after or instead of selling us nuclear coolant pumps. After a few years as President of the Hartford M.I.T. Club, I have graduated to the position of Director now. I'll try to become a better correspondent in the future, in the meantime, Best Personal Regards."

Don Dewitt joins the group with the following letter: "My daughter recently brought home a copy of the yearbook of the University of Wisconsin, which of course led to my searching out and dusting off some old copies of *Technique.* This led to some strong feelings of nostalgia which were followed by the thought: 'Gee, I haven't written my regular? letter to the class secretary.' (Regular means religiously every decade.) I think, however, it was reading in last month's column that Claude Brenner was married, I realized that time does fly if Claude is old enough to get married. Marian and I celebrated our twenty-first anniversary in March. We have a daughter Didi already mentioned, who is a sophomore at Wisconsin, and three boys Jimmy, 16, Danny 11, and Michael who is two and who obviously is the center of attention in the Dewitt Family. We have been in California for 15 years and I am still in the machine tool supply business. I am by now a 'native' southern Califor-

nian and am delighted with living here. Don't miss the New York or New England winters. I *hope,* one of these years, to attend a class reunion, certainly the 25th, if not before."

A timely note from the clipping services advises that **Art** (William H.) **Lucero** played a major role in the Apollo 11 mission through his engineering activities with N.A.S.A. in Huntsville Ala. . . . Our Class was represented at Alumni Day by Mr. and Mrs. Claude Brenner, Mr. and Mrs. Stanley (James S.) Cobb, Marty Haas, Bob Hagopian, Bill Page, Jim Phillips, Mr. and Mrs. Marty Philips and Mr. and Mrs. Jack Rizika. Trust that all had an enjoyable time. . . . I see that **Ken Marshall** spent 13 weeks at Harvard attending the Advanced Management Program at the Business School. He probably had a chance to see quite a few of the Boston group while there but was back in Missouri by Alumni Day. . . . **Mitchell Keamy** has been appointed general manager of Allis Chalmers' new Cement and Mining Systems Division. . . . **James Haggett** has been appointed manager of engineering for the grinding wheel division of Norton Co.

Among the moves this year we find the following going West: Gene Gettel to Phoenix, Ariz.; Dan Carmody to San Francisco, and Willis Reals to Westport, Conn. My geography is still correct as he moved from England. Going East we have: Ed Cote to Wilmington, Del.; Crawford Bown to Short Hills, N.J., and Bob Athow to Alexandria, Va.

Following are two notes that to me seem rather amusingly parallel to arrive in one month. **Ben Ciscel** writes: "We have a darling 2-year-old daughter who is the pivot point of our lives. Oldest son David gets his Ph.D. at the University of Houston this year. I am at Autonetics working on Laser programs." **Warren Larson** writes: "A daughter Karen was born on Patriots Day April 19, 1969. Son David is a student at Tufts and other daughter Wendy graduates from Lexington High School this year." Warren is presently production manager at the Supercan Division of Norton.

Now for several rounds of golf and then I had better get back to work to be sure that Jack DiSaveno doesn't get all of the pump orders. Please find a pencil and write.—**Dick O'Donnell,** Secretary, 28516 Lincoln Rd., Bay Village, Ohio 44140

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When classes resume in September, 1969, at least two of the freshman will be students whose fathers are '48 alumni. **Arthur Teager**'s daughter Margaret Irene (her initials are M.I.T.), valedictorian at her high school and **Arnold Smith**'s son Clark Robert who will live in the M.I.T. Student House.

Charles Licht of Chicago has his consulting firm off to a fruitful start in the area of secondary metal operations. . . . **Ben Hrazdira** left his native country—Czechoslovakia—in November, 1968, with his whole family and went to Canada. Ben is working for Westeel-Rosco Ltd., in Toronto. . . . **Leo Martin,** Course X, has received his M.B.A. from the University of Chicago. . . . **Samuel Labate,** Course VI, has become president of Bolt, Beranek, and Newman, Inc. . . . **Richard S. White,** Course XV, president of Automation Engineering Laboratory, Inc., has been elected a director of I.T.E. Imperial Corporation (Philadelphia), the electrical equipment concern. . . . **William J. Weisz,** Course VI, Vice President and General Manager of the communications division of Motorola, Inc. (Chicago) will become president and chief operating officer of the company in May 1972, when Elmer H. Wavering, the current president and chief operating officer, is scheduled to retire.

Dan Fink, Course XVI, continues his professional society activity as a director of the A.I.A.A.'s Technical Activities Committee. . . . **Dick Harris,** director of corporate development at Norton Co., has been elected president and treasurer of the Curtis and Marble Machine Co. . . . Commander **Howard B. Gibbs** has retired from the Navy and is working for Boeing.

Lieutenant Colonel **Fiorenzo D. Losco** has retired from the Army and is a mathematics professor at Atlantic Community College in N.J. . . . **George S. Shields** has a new position at the Good Samaritan Hospital in Cincinnati, Ohio, where he will be Director, Department of Medical Systems, responsible for application of computers to medical care. . . . **Barry M. Bloom,** has been named a vice president of Pfizer Pharmaceuticals. . . . **Robert A. Miller,** Course X, has been appointed works manager responsible for foundry operations at Genecast, a division of General Railway Signal Company.

Vaughn L. Beals, Jr., has been elected executive vice president and director of Cummins Engine Co. . . . **Lawrence J. Degan** of G.E.'s Advanced Systems and Planning Operation participated in G.E.'s unique work-study program and received his Ph.D. while he was also a member of the corporate engineering staff. . . . **Harrison E. Rowe,** Course VI, of Bell Telephone Laboratories has published *Spectral Density Bounds of a PM Wave. . . .* **Bob Sandman,** President of Sandman Electric Co., Boston, Mass., helped in the preparation of an article describing his company and its policy—that selling equipment is part of the total service concept that includes service, repair and a sound inventory policy.

Stanley S. Shein was the 1968/1969 president of the M.I.T. Stein Club. Stanley is executive director of Management Techniques. . . . **Victor H. Pomper** has been elected president of H. H. Scott, Inc. . . . **Richard J. Hall,** Course VI, has been appointed manager of the R.C.A. Micro-Circuit Department. The R.C.A. printed circuit facility is completely automated and can produce complex printed circuits up to 30 layers in construction and up to 24 inches by 24 inches in size. . . . **John M. D. Walch** was promoted to senior engineer, General Office, by the Public Service Electric and Gas Company in New Jersey. . . . **William H. Brauer** has been named president of Brauer Supply Co., a heating, air conditioning, and industrial insulation supply house. Bill is the third generation to head the 87-year-old firm founded by his grandfather.

Stephen T. Davenport has moved again; Europe from 1965 to 1967, California until the fall of 1968 and now Westport, Conn. Stephen is an area manager of pipelines for Bechtel Corporation. The family has a horse and their 17-year-old daughter Diana enjoys competing in local horse shows. . . . Mrs. **Sara B. Michal** is now a high school chemistry teacher in New Jersey. She has three sons (17, 15 and 10 years) and one daughter (13 years). Their hobbies include mineral collections, weather forecasting, butterfly and moth collections, etc. The family spends summers camping in national parks. . . . **Robert E. Chandler** is vice president of the Diversey Corporation and is currently responsible for corporate R and D which includes coordinating R and D activities in all subsidiary companies around the world. His wife Mae is teaching in high school, daughter Patricia is a high school senior and son Robert is a third year biology major at Ripon College.

Dr. Leonard Stutman is responsible for research varying from molecular biology of red cell membranes to prevention of clot formation as Director of the Blood Research Center at St. Vincent's Hospital in New York. He is also Medical Director of the Presidential Life Insurance Company. . . . **Daniel R. Muss** has been made manager of Solid State Device R and D at Westinghouse Research Labs. . . . **Ronald J. R. Kallman** has moved his family to the West Coast where he will open operations for the Auerbach Corp., a leading consulting firm in information systems. Ron writes that, "business and the mountains are doing well and suit us admirably." . . . **Walter R. Connell** writes that he was recently named Marketing Manager-Elastomers for Stuaffer-Wacker Silicone Corp.

The death of **George R. Pepin** in June, 1969, was reported in the Springfield, Mass., newspaper. George owned and operated Crescent Welding Supply Co., until he retired in 1962. Our sympathy is expressed to George's wife and four children.

A Memorial Service for M.I.T. Alumni is held at the M.I.T. Chapel on Alumni Day in June. This year in addition to George Pepin, the service included a memorial for George J. Maritz and John H. Wright who also died during the past year.

I am looking for some volunteers to help improve the quality of our class notes. I have several ideas to improve the quality of the communication in our notes. However, the actual direction we take in changing our column will depend on the

interchange of ideas between the volunteers and the present secretary and two assistant secretaries. Last year at our 20th reunion several wives of '48 alumni told me they read our column and I would appreciate the help of any alumnus or his wife.

You may have noted that the '48 column was missing from several issues of the *Review*. I report without further comment that only Ken Brock spoke of its absence. —**S. Martin Billett,** Secretary, 16 Greenwood Ave., Barrington, R.I. 02806

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Having volunteered for another five year stint as Class Secretary, and having been accepted, NOW I come face to face with the first *Technology Review* deadline of the year and suddenly remember what the job is all about. Oh well, getting started is the hardest part as I remember it; there are only nine deadlines this year, surely not an intolerable number. At least there is no shortage of news and class notes this month. Instead, I have the problem of deciding which items to postpone until next month.

The M.I.T. Class of 1949's 20th reunion at the Castle Harbour Hotel in Bermuda was a smashing success for the 100 participants. In attendance were 39 classmates, 33 spouses, 26 children and two in-laws. Stan and Ros Margolin received and deserved a standing ovation for the long hours of careful work which made the reunion a delight for all who attended. The hallmark of the reunion was relaxed informality and a minimum of organized activities, principally a welcoming cocktail party on Thursday, a beachside barbecue, dance and limbo contest on Friday night, and the once-every-five-year class meeting and banquet on Saturday. For me, the high spots which linger in memory include rushing full-tilt after Stan Margolin down the left hand side of the narrow Bermuda roads, wind whistling past my ears; swimming and sunning luxuriously at the beautiful, pink beach; unexpectedly receiving (as Class Secretary, in trust) a genuine Norwegian beaver skull from Diderik Cappelen, who had carried it lovingly with him to the reunion from Ulefoss, Norway; and finally, having to replace a number of my credit cards because Sonya's purse was stolen at the airport on the way home. Despite the minor problems at the end, it was a wonderful reunion for me, largely because of the opportunity to make friends anew with old friends. Here is the list of those who attended. Ask any of them if you should come along if we try to do it again at our 25th reunion.

Jack and Evelyn Barriger, Milt and Paula Bevington, Anatol Bigus, Fred and Helen Blatt, Donal and Jacquelyn Botway, Pete and Helen Cambourelis, Diderik and Louise Cappelen, Dick and Joan Cotton, Alex and Brit d'Arbeloff, Joe and Evelyn Day, Ira and Betty Dyer, Roberto Galvez B., Jim and Susie Gordon, Bob and Dagmar Hamman, Frank and Sonya Hulswit, Malcolm and Doris Kurth, Harry and Jean Lambe, Harry Lang, Ray and Muriel Larson, Mickey and Pam Ligor, Stan and Roslyn Margolin, Frank and Marjorie Marran, Jack and Munya Miller, David and Marjorie Moore, Leonard and Ruby Newton, Paul and Jacqueline Ostergaard, Ken and Emmy Pettengill, George and Martha Ray, Ed Richardson, Peter Saint Germain, Joe and Eunice Schneider, Ed and Vera Somma, Bernard and Jacqueline Steinberg, Charles and Jeanne Sutherland, Harrison and Anna Thibault, Tom and Mary Toohy, Harvey and Sonna Tuck, Bob Walton, Paul and Virginia Weamer.

A total of 12 classmates and four wives attended Alumni Day, June 16: Anatol Bigus, James Christopher, Mr. and Mrs. Frank Dinneen, Mr. and Mrs. Wallace Douglas, Mr. and Mrs. Fletcher Eaton, William Edgerly, Mrs. Mary Lavine, Stanley Margolin, Mr. and Mrs. J. Arthur Matey, Lewis Roosa, Robert Walton, and Richard Witherell. Incidentally, Stan Margolin wishes to announce that the Class of 1949 will reinstate our Annual Cocktail Party on Alumni Day. Plan to be there next year.

A number of people wrote notes to the Class Secretary via the M.I.T. Alumni Fund envelope flaps. Mrs. **Barbara Feeney Powers** reports that she has just earned her master's degree from Rockford College. Barbara also reports that her son, Stephen, will join the freshman class (1973) at M.I.T. this September. . . . **Benjamin D. Cowley** reports he is working for du Pont in Research and Development. He has been in Louisville, Ky., Montague, Mich., and Beaumont, Texas with the Elastomer Chemicals Department since 1955. He is married and has two children, a boy and a girl (12 and 9 years old). **Henry L.** (Hank) **Henze** reports his delight at having his daughter, Janice, enter M.I.T. as a freshman next fall. She is one of several Grumman Scholars starting at the Institute and plans to major in mathematics.

George E. Williams reports that he is now Group Controller, with financial responsibilities for three divisions of United Aircraft Corporation, each with its own controller. . . . **Donn F. Pennell** reports from the San Francisco Bay area that he is currently on active duty with the Navy as a Commander. . . . **Paul A. Hurney, Jr.,** is now President of Digital Technology, Inc., of Waltham, Mass., a wholly owned subsidiary of Adams Russell Co. . . . **Gideon M. Boyd** reports that he is now an engineer with Lockheed (Missiles and Space) after retiring as a Captain from the U.S. Navy in February, 1968.

Charles O. Miller reports "Recently spent several days in Boston; involved in a public hearing concerning an air carrier accident (as Director of Aviation Safety, National Transportation Safety Board . . . since last fall). Scollay Square just isn't the same, but the memory of Sally lingers on." . . . Mrs. **Robert Darden, Jr.,** reports that Bob is President of Consolidated Furniture Industries, the furniture division of Magnavox, Lenoir, N.C. . . . **Elton H. Bell** reports that on January 1, 1969, he was elected a Vice President with Irving Lundborg & Co., San Francisco, Calif., members of the New York, American and Pacific Coast Stock Exchanges. He began with them as a registered representative in January of 1962.

From the *Sylvania News* we learn that **John W. Barriger, 4th,** is now a director of the M.I.T. Alumni Association, having served in a number of M.I.T. alumni activities, including Educational Counselor, Regional Fund Drive Chairman, President of the M.I.T Club of Los Angeles, and Director of the M.I.T. Club of Chicago. . . . Dr. **William Haddon, Jr.,** was named in January as a 1969 recipient of the Modern Medicine Distinguished Achievement Award. He was cited for "trail blazing scientific research in causes of traffic trauma and administrative efforts to promote highway safety." In March, Dr. Haddon assumed the presidency of the Insurance Institute for Highway Safety. His appointment marks a new phase in the activities of the I.I.H.S. as an independent, non-governmental force working for highway safety.

William C. Schneider has been director, Apollo Applications Program in N.A.S.A.'s Office of Manned Space Flight in Washington, since early in 1969. This office is responsible for the planning, direction, execution, and evaluation of N.A.S.A.'s overall manned space flight program. . . . Early in June, the Defense Communications Agency News reported that **David R. Israel,** Deputy Director, Defense Communications Planning Group, had been awarded the Secretary of Defense Meritorious Civilian Service Medal, the highest such award made by the Office, Secretary of Defense. Previously with the MITRE Corporation, he has been on leave for the past two years. While at MITRE he consulted and participated in negotiations for DDR&E in the design of the N.A.T.O. and Japanese semi-automatic (ground environment) air defense systems, known by the acronyms NADGE and BADGE. . . . On the assumption that this column will get in under the wire for the October issue, I'll see you all again next month as well.—**Frank T. Hulswit,** Secretary, 77 Temple Rd., Concord, Mass. 01742

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Dynamics Research Corporation, of Stoneham, Mass. has elected **Albert Rand** Vice President in charge of Systems Division, located in Wilmington, Mass. Mr. Rand, formerly head of the Systems Evaluation Group and the Company's Computing Center, joined Dynamics Research as an engineer in 1960. Mr. Rand makes his home in Newton Center. . . . **R. Stanley Bair** has opened his own office as a practicing architect and engineer. . . . **Sidney A. Corderman,** with McIntosh Laboratory, Inc., manufacturer of Hi-Fi and stereo equipment, for 18 years, is Vice President of Re-

search and Development. He lives in Binghamton, N.Y., with his wife, Sarah Jo and their four children. . . . **Paul A. F. Mourier-Petersen** is still residing in Sao Paulo, Brazil, as the Managing Director of Dorr-Oliver (Brazil) L.T.D.A. and Director of South American Operations for Dorr-Oliver, Inc.

Dorothy W. Pelzer is rounding out five years of work all over Southeast Asia for a book on the architecture of the whole Southeast Asian cultural region. **Jack J. Jackson** has now been elected a Vice President of the Great American Insurance Co. and the American National Fire Insurance Co. He will be responsible for information services including the activities of the data processing and methods and planning departments. Prior to assuming his present position, Mr. Jackson was Secretary and Director of Data Processing at Royal Globe. . . . **James M. Lydon,** of Wayland, Mass., has been named Vice President-Public Relations of Boston Edison Co. A member of the Advertising Club of Greater Boston, Institute of Electrical and Electronic Engineers, and a director of the Electric Institute of Greater Boston, he is also a member of Edison Electric Institute Public Relations Committee. Mr. Lydon is married to the former Jean Cogger; they have four sons and two daughters.

Robert J. Cantwell is currently with Gary Cantwell Co. Bob's son is a member of the Class of '72. . . . **John D. Yerger, Jr.,** has been transferred to Warrick Operations of Aluminum Co. of America as Chief Metallurgist. He is also currently serving as Education Counselor for M.I.T. in the Evansville area. . . . **Mark Alfandary-Alexander** is practicing Operations Research at U.S. Atomic Energy Commission Headquarters, near Washington, D.C. . . . **Paul Slepian** (GS), Professor of Mathematics at R.P.I. for the past six years, became Professor of Mathematics at Bucknell July 1. His most recent book, *Mathematical Foundations of Network Analysis,* was published in December. . . . **Thomas E. Mea** is presently Purchasing Agent at the Blanchard Machine Co., in Cambridge. He is married, has three children and lives in Burlington.

William H. Enders is now Director of Advanced Product Planning for R.C.A. with an office in the R.C.A. Building at Rockefeller Center. Responsible for coordinating advanced product planning for the product divisions, he commutes daily from his home in Princeton, N.J., where he lives with his wife, Jean, and children: Gregory (high school freshman, age 14) and Kimberly, age 10. He has just become the owner of a home on Lake Sunapee, Newbury, N.H., where the skiing was great this past winter. . . . **Herbert A. Shepard,** prominent educator and industrial consultant in the behavioral sciences, has been elected to the Board of Directors of Dorr-Oliver Inc. Professor Shepard is presently a consultant to many leading corporations and a visiting professor at Yale Medical School, the Whittemore School of Business of the University of New Hampshire and the Graduate Department of Industrial Administration of Iona College. Professor Shepard resides with his family in Stamford, Connecticut.

Joseph D'Annunzio, President of D'Annunzio Bros., Inc., located at 2435 Plainfield Ave., Scotch Plains, N.J., has changed his home address to James Court, Scotch Plains. He is Chairman of the Union County Planning Board and Vice President of the National Contractor's Association. He recently was the low bidder on a $5,000,000 plant in New Jersey. . . . **Nate Cook,** Collie and their four children, spent a wonderful six and one-half months in India. The visit was in conjunction with the M.I.T.-Ford Foundation cooperative effort with the Birla Institute of Technology and Science, Pilani, RAJ. Nate has been in India twice recently but this was the first time for all six of them. . . . After a one-year stay in southern California, **Jordan Loftus** and his family are moving to Houston, Texas. Last year he was a full-time consultant to Fluor Corporation but now plans to open a consultant office in Houston widening his services to include specialized computer software. He would be very happy to meet classmates when they are in his area—5511 Rutherglen, Houston, Texas, Tel: 713-729-4041.

Albert J. Romano is now Manager of European and mid-Eastern Operations at the Data Systems Division of Litton Systems S.A., in Brussels, Belgium. His work involves general N.A.T.O. defense problems and the unique defense problems of member nations. This is his third European assignment; from 1963 to 1965 he was stationed in Rome for Univac Defense Systems and from January, 1968, to December, 1968, he was stationed in London working for Litton Defense Systems. Mr. Romano and his three daughters, Susan, Robin and Diane, have been in Brussels since January, 1969. . . . **Walter R. Hylander, Jr.,** was recently promoted to the rank of Colonel, U.S. Army. Currently serving as Chief, Operations Branch, in the Weapons Evaluation and Control Bureau of the U.S. Arms Control and Disarmament Agency in Washington, he is a veteran of Vietnam where he served as Senior Advisor to the commandant of the Republic of Vietnam Armed Forces Engineer School. Colonel Hylander was cited for defeating a Viet Cong attack on the school and for conceiving and implementing a long-range plan for its postwar development. From 1959 to 1961 Colonel Hylander was an R and D project officer on the Army Staff for geodetic satellite and lunar mapping programs and coordinated these activities with N.A.S.A.; from 1962 to 1965, he was U.S. engineer standardization representative in London, where he also served as chairman of the N.A.T.O. Panel of Experts on Land Minefield Marking and Recording. A teacher of physics from 1951 to 1954 at West Point, during 1954 and 1955, Colonel Hylander worked for the Sandia Corporation in Albuquerque as a designer of nuclear weapons storage and handling facilities, and as a consulting engineer in Memphis rejoining the Army in 1957. Colonel Hylander now lives in Manassas, Va., with his wife, the former Jean Gunter of Grenada, Miss., and their two children, Ray, 16, and Joy, 14.

Harry L. Reed, Jr., has been promoted to Scientific Advisor for Brigadier General Thomas W. Mellen, Director of Developments, Office of the Chief of Research and Developments in Washington, D.C. . . . **Richard D'Amato** has been elected Vice President-Research and Development for Electronic Space Structures Corporation, West Concord, Mass. . . . **Juan Navia y de la Campa,** Associate Professor of Nutrition and Food Science, University of Alabama, resigned effective January 31, 1969. . . . **John H. Ludes** has been named Product Manager at Thompson Plastics, a subsidiary of Olin Mathieson Chemical Corporation of New York. . . . **Warren F. Clement** is the co-author of a paper on application of a theory for manual control displays to the instrument landing approach of a large subsonic jet transport. A methodical procedure is disclosed for formulation of compensatory display-control systems.—**John T. McKenna, Jr.,** Secretary, 2 Francis Kelly Rd., Bedford, Mass. 01730

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My first indication of winter is the notice that the Class Secretaries receive in the middle of the summer to let us know that copy is due for the fall issue of the *Review.* With this I know that the kids will be coming home from summer camp, school will be starting and the summer respite from organized activities is over. . . . For starters this year, I thought that I would excerpt a few letters that we have received over the not too distant past. It is sort of a dirty trick giving you the following because **Mickey Alper** sent it to me with a previous set of notes. I suppose that this violates a confidence, but class secretaries shouldn't be expected to keep newsworthy items quiet. Mickey, as you know, is one of our Class Secretaries; he is with J.P.L. in Pasadena. With his wife, Marcia, recently he became involved in local (Pasadena) elections. He wrote: ". . . the issue is a School Board, a $34 million bond and tax override, and two days later a couple of seats on the city Board of Directors. The workings of local politics are wonderous to behold. . . . Some technology devoted to a means for translating public issues as a function of the intelligence of the voter would sure help." The machinations of the politicos with the attendant frustrations of ascertaining the true facts were very revealing to Mickey and he concluded that "It's been interesting, tiring and frightening." Mickey, who won?

Hal Siegel is a rock of stability, yet when I write about him, Connie and their multiplicity of twins, they choose just that time to change the status quo. I waited a bit before releasing this, and not having heard to the contrary I'll try to update his

activities. Hal too has been active in civic affairs and politics. An endless run of leadership positions in everything from Chamber of Commerce, P.T.A., professional societies, etc., culminated in a race for Mayor of Greenbelt Md.—Hal was edged out by about 200 votes. The Siegels then proceeded to back a Republican congressman in the heavily Democratic 5th Congressional District of Maryland, and their candidate won. Employment: in 18 years Hal has been with only three companies, one of which was a short transition period prior to making his current affiliation with Radiation Systems, Inc., in McLean Va. Hal is house counsel for R.S.I., but also carries on a private law practice in Greenbelt. All of their children are now in school and this, I presume, frees Consuelo from the rigors of entertaining the little ones at home.

Has anyone run into **Jim** (John) **Vernon?** Last I heard he had reported back to Aruba and Standard Oil and had been transferred to Esso Pappas: Standard Oil in Athens, Greece. Jim and Elizabeth have three children, a girl about 14 and two younger boys. . . . **Bill Lucas** left New Jersey (W.R. Grace) to return to Houston, Texas, where he has joined Ashland Chemical Co. The Lucases have two sons: 9 and 7, and a daughter about one year old. . . . Alumni Day—guess it is now called Homecoming—saw essentially the same crew at the '51 luncheon table: Chuck Heiken, Breene Kerr, Hank Spaulding, Charles Miller, Dick Reedy, Ralph Regan, Sam Rubinovitz, Dan and Louise Sullivan with their children, Howard Levingston, and your class president, Marvin Grossman, actively seeking a reunion chairman. Any volunteers?

The interesting return address: U.S.A.I.D., American Embassy, Bogotà, Colombia on a recent letter correctly supported our contention that the contents must also be interesting. **William G.** (Bill) **Rhoads** has been in Colombia for almost four years. His first assignment had been as head of the Public Finance Division in the A.I.D. Mission, and more recently he has been Assistant Director in charge of planning and programming for the entire A.I.D. program in Colombia. Over this period Bill has been instrumental in negotiating development loans to Colombia and to ensure that this assistance supplements Colombia's own efforts without substituting for it. During this period the country has doubled its investment budget, avoided inflationary borrowing and moved ahead very well. A new National Science Council and National Science and Technology fund has been established. Bill has worked on this with two other M.I.T. alumni: Oliverio Philips, '48, Science advisor to Colombia's president, and Alberto Ospina, '58, Director of the new council and fund. He notes that M.I.T. alumni are very active and influential in Colombia, and there is an active M.I.T. club in Bogotà. Bill has been teaching advanced economic theory in the graduate school at the University of the Andes in Bogotà, and has been interviewing Colombian applicants for U.S. graduate schools—this in addition to his official duties. "Despite all the inevitable frustrations and difficulties, this is a very satisfying place for an economist to be," wrote Bill, "for there is a great deal of interest among the young Colombians, and in the last few years they have been showing that they have a great deal to contribute in promoting the development of their country." Bill certainly has contributed a great deal himself, not only to Colombia and the other countries where he has given of his time and knowledge, but to the United States as well in giving of himself to so many projects that help to project our sincere interest in helping countries to develop. Bill deserves a great deal of credit for his work, and our good wishes for successful continuation of his mission. Thanks for an inspiring letter, Bill.—**Howard L. Levingston,** Secretary, 358 Emerson Rd., Lexington, Mass. 02173; Assistant Secretaries: **Marshall Alper,** 1130 Coronet Ave., Pasadena Calif. 91107; **Walter Davis,** 346 Forest Ave., Brockton, Mass. 02401; **Paul Smith,** 11 Old Farm Rd., North Caldwell, N.J. 07006

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Our classmates are doing very well in business and industry. **Nathan Levine** writes that he has recently been appointed Director of the Defense Systems Laboratory at Bell Telephone Laboratories, Whippany, N.J. We hear via the *Wall Street Journal* that **James S. Stolley** is Vice President of Hammermill Paper Company of Erie, Pa., and has recently been elected Director. . . . The new General Manager of the Appliance and Automotive Division of Controls Company of America is **Eugene D. Scalera.** . . . **James B. Borden,** a Course XV S.M., has recently been named Process Superintendent of the Kinston Dacron Plant of du Pont Company in Kinston, N.C.

Gene Erbin has written a very nice letter indicating that he has recently been appointed General Manager of Magnesium Division National Lead Company in Salt Lake City, Utah. He will be extracting magnesium metal plus a number of coproducts from the waters of the Great Salt Lake. Gene is a Course III graduate with a masters degree in metallurgy, 1953, and has worked with Titanium Metals Corporation of America in New York City for 15 years. He will be moving with his wife, Joan and six children to Salt Lake City in August for his new position. . . . The Air Force has announced that Major **Brian G. Moore** has been decorated with the Distinguished Flying Cross and the Bronze Star for actions in Viet Nam. Major Moore received the S.B. degree in civil engineering and earned his commission through the R.O.T.C. program at M.I.T. He later earned an M.S. at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio, and is now serving as an Operations Staff Officer at Headquarters Pacific Air Forces.

Hugh J. Robertson, who is Project Manager of the Active Optics Program at the Perkin-Elmer Corporation, Norwalk, Connecticut, has recently co-authored a paper, "Evaluation of Multipoint Interaction in the Design of a Thin Diffraction Limited Mirror," published in the *IEEE Transactions on Aerospace and Electronics Systems.* Hugh has both an S.B. and S.M. in physics from M.I.T. where he was active in the Spectroscopy Laboratory. From 1954 until 1965 he was a member of the technical staff at the Bell Telephone Laboratories where he participated in the development of optical and magnetic memory devices for the Bell Systems Electronic Switching System. He has been at Perkin-Elmer since 1965.

Several of our classmates write that they are taking up new careers and responsibilities. **Eugene P. Schact** has recently received his D.D.S. degree from the University of California Medical Center, San Francisco. He will be practicing at Sausalito, Calif. . . . **Stanley J. Dorst** has has been appointed Vice President of Chevron Land Company in San Francisco where he will be in charge of planning real estate projects for Standard Oil Company of California. . . . **Daniel H. Lufkin** is just starting an assignment as Director of Air Force Solar Forecast Facility. . . . **Donald Surgenor** has resigned as Assistant to the General Manager of the Seattle Division of Todd Shipyard to become General Manager of the Hohn Corporation a subsidiary of the S.S. Millen Company.

Also in this month's mail we have a note from **Donald C. Union** who writes that he has been with I.B.M. for six years and is now Senior Analyst in their Houston Development Center. Donald is designer for I.B.M.'s industrial computer control language PROSPRO. He and wife, Vi, have very active sons ages 9 and 7 . . . . **Bill Ferguson** writes that he has just started a new career as Metallurgical Test Engineer at the Concentrator, Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Ariz. Bill has recently retired from the Army after 22 years of service. . . . Mrs. **Frances Richey Oberheim** writes that she is a Director and Chief Scientist of Oberheim Associates Inc., Washington, D.C. She describes Oberheim Associates as "a sophisticated Booz-Allen with shades of Arthur D. Little." Oberheim Associates has as clients the Departments of Defense, Interior and Transportation.

Another of our classmates in the "think tank" business is Dr. **Louis B. Lambert,** of Mt. Vernon, N.Y., who has recently been named Vice President at Riverside Research Institute, a non-profit science and engineering research organization located in New York City. Riverside Research Institute is an offshoot of the former Electronics Research Laboratory, of Columbia University and is concerned with solving non defense problems in the areas of urban systems for police, fire and environmental control departments, educational techniques, research pro-

gram evaluation studies, and engineering for medicine. . . . The world travelers in the class are much fewer in number than usual. We have a note from **Charles P. Marion** who was in Japan for about 4 weeks during the summer in connection with licensing a Texaco Development Corporation reducing gas generation unit to feed the No. 3 Blast Furnace at Hirohata Works of Fuji Iron and Steel Company. . . . **Werner Kahn** writes that he has settled down at Buenos Aires, Argentina, after a four year stay in Lima, Peru. Werner is Gulf Oil's representative on the east coast of South America. He married a Brazilian girl, Dinair, in 1964 and has a daughter.

It is with regret that we record the passing of two of our classmates. **Ronald L. Thompson** died suddenly September 5, 1968 at Luba City, Ariz. He was 38 years old. At the time of his death Ronald was manager of the Radar Activity, Aeroneutronic Division, Philco Ford, Newport Beach, Calif. He had received an S.B. and S.M. from M.I.T. in Course VI-A, the electrical engineering cooperative course.

Gerald F. Laufs died January 5, 1969. Jerry was a chemical engineering graduate and at the time of his death was Manager of Natural Gas Operations for Esso AG, Hamburg, Germany.—**Arthur S. Turner,** Secretary, Lowell St., Carlisle, Mass. 01741

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Robert Anslow has been elected a Vice President of Roanwell Corporation and continues to serve as Comptroller, a position he has held since 1967. . . . **Peter Arcidiacono** is Chief of Aerodynamics at the United Aircraft Research Labs. Pete resides in East Hampton, Conn., with wife and three children. . . . **Bruce Backe** has been appointed Vice President-Operations of Imlac Corp., Waltham, Mass., where he will be responsible for overall production, purchasing, and quality control of the complete product line.

George D. Becher has moved to North Salt Lake to become manager of the American Pad and Paper Company's new manufacturing plant. . . . Air Force Lieutenant Colonel **Herbert Bell** is currently assigned to the Surgeon General's Office HQUSAF as Associate Chief for Bioenvironmental Engineering for the Biomedical Sciences Corps. He is "responsible for air and water pollution control plus numerous other things related to environmental control." . . . **James W. Brown** has been promoted to Vice President and General Manager of Fabricated Plastics at Vistron Corporation. . . . **David Dennen** has been promoted to Manager of Antibiotics Development at Eli Lilly Co., in Indianapolis. Dr. Dennen had been Senior Microbiologist.

Lieutenant Colonel **Sy Grossman** was certified in his subspecialty of Gastroenterology by the American Board of Internal Medicine. Bonnie, Sy, and their two children have re-entered civilian life, returning to Berkeley where Sy rejoined the Permanente Medical Group in Oakland. . . . U.S.A.F. Major **Frederick Hofmann** has been graduated from the Armed Forces Staff College at Norfolk, Va. . . . **Ronald L. McKay** is still working with Bolt Beranek and Newman Inc., having moved from Clarendon Hills, Ill., to Woodland Hills, Calif., in July 1968. He reports enjoying their first snow-free winter. Ronald is presently senior consultant and associate manager for architectural acoustics in the Los Angeles Office.

George Philips has joined Foto Fair International as President and moved to Dayton, Ohio. . . . **Dale Small** received his law degree, J.D., from George Washington University in 1958 and will receive his M.B.A. from the University of Detroit in 1969. He married Carole Dennis of Detroit in 1968. . . . **Paul Spreiregen** spent the summer in southern France teaching architecture and town planning to a group of students from the University of Tennessee. . . . A report on the 15th reunion will be included in a forth-coming issue. Class officers elected at the reunion were: **Robert Warshawer,** President; **Vic Ellins,** Vice President; **George Inada,** Secretary; **Robert Evans,** Treasurer; and **Charles Masison** and **Dean Jacoby,** Class Agents.—**E. David Howes, Jr.,** for **George Inada,** Secretary, The MITRE Corp., 1820 Dolly Madison Blvd., McLean, Va. 22101

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It's hard enough to return to Flatland (Wilmington) after climbing in the Adirondacks without finding a postcard saying that the first class notes of the season are due in a few days! We had a very pleasant and refreshing vacation though: David, going on four, can climb a few small mountains now; and long-legged Bruce, almost seven, will probably leave his mother behind next year.

To face reality at its hardest we must inform you of the death of **Daniel Vappi** of Milton in June after a long illness, and express our sympathy to his family.

Robert Cruickshank was named Assistant Chief Engineer of the Manufacturing Engineering Department of Ashland Oil and Refining Co. last January in Ashland, Ky. . . . About the same time **William Deibel** became Manager of Product Development for the Eaton Marion Division of Eaton Yale and Towne Inc., Cleveland. Bill and his wife and Marjory live in Marion, Ohio. . . . In June Titanium Metals Corporation of America in Caldwell, N.J., announced the appointment of **Roger Broadwell** to the position of General Manager, Technical Service and Market Development. Roger and his family live in Berkeley Heights, N.J.

Air Force Cambridge Research Laboratories has announced the June installation of laser range-finding equipment at its new Lunar Laser Observatory 40 miles north of Tucson, Ariz. In a program under the direction of **Donald Eckhardt** a high power laser light pulse will be directed toward special reflectors placed on the moon by Apollo astronauts, providing more accurate measurements of distances to the moon and information about the earth's rotation—and, in coordination with other similar observatories, measurements of the rate of continental drift. . . . **Ishan Haddad** has become Vice President of Engineering Chemistry of Instrumentation Laboratory, Inc., Lexington. He is also General Manager of Ingold Electrodes U.S.A., I.L.'s electrode manufacturing facility. With Carmen and their two children he lives in Bedford. . . . **Melvin Weiner,** Consultant in Electrical Engineering in Brookline, has been elected a National Director of Eta Kappa Nu. A past President and Vice President of the Boston Alumni Chapter and chairman of several committees, Melvin has been especially effective as Chairman of the Motor Vehicle Safety Committee, which has grown rapidly since its formation in 1962 for the purpose of providing communication among the various scientific and engineering disciplines in the field of motor vehicle safety.

At M.I.T. on Alumni Day our Class was represented by Jim Eacker, Bob Greene, and Dennis Shapiro. Perhaps the calm before the storm next year? . . . The Institute has announced the promotion of **Robert Coble,** Sc.D., and **Thomas Dupree** Ph.D., to Professor, the former in metallurgy and materials science, the latter in nuclear engineering. Also for the year beginning in July **Surendra Shah** has been appointed Visiting Associate Professor in civil engineering. . . . From the Sloan School comes the news that **Hua Lin,** Sc.D., Chief of Missile Technology with Boeing in Seattle, participated in the Spring 1969 Session of the M.I.T. Program for Senior Executives; and the announcement that **Henry Hebeler** and **David Wilbourn** are among the 50 recipients of Alfred P. Sloan Fellowships for 1969-1970. Henry, who lives in Bellevue, Wash., is Deputy Manager of the Advanced Surface Missile System Branch of Boeing in Seattle. Dave is Vice President-Manufacturing of Baird Chemical Industries in New York City and lives in Croton-on-Hudson. . . . Lots of good news items on the Alumni Fund return envelopes, but perhaps I'd better pass them on to your Boston correspondent for next month.—Secretaries: **Mrs. J. H. Venarde** (Dell Lanier), 16 South Trail, Wilmington, Del. 19803; **L. Dennis Shapiro,** Aerospace Research, Inc., 130 Lincoln St., Boston, Mass. 02135

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Valentin Berger is a research engineer in the Impact Mechanics Lab at Boeing. In the evening he is working on his M.B.A. at Seattle University. . . . **Don Block** has been appointed Director-Project Management, of Astrodata in Anaheim, Calif. Previously Don was Technical Director at Redcor Corporation.

Don and Gail and their two sons continue to live in Los Angeles. . . . **Jerry Davis** is working on his Ph.D. in chemical engineering at the University of Massachusetts. . . . **Chuck Dietrich** at Bolt Beranek & Newman has made a study of noise sources in a high speed ground transportation system and the government published it in October 1968. Then in April, 1969, the government published *Fission Chain Analysis Tables for Odd Mass Values* by **Pete Alexander.** . . . **Ken Dunipace** completed his Ph.D. in electrical engineering in June 1968 and is now an associate professor at the University of Missouri-Rolla. . . . **Phil Lieberman** has been appointed Professor of Linguistics and Electrical Engineering at the University of Connecticut. . . . **Bill McNulty** has been appointed manager of engineering of I.T.T. World Communications. Bill, Nancy and son James live in Chappaqua, N.Y. **Bruce Montgomery** recently wrote a book, *Solenoid Magnet Design.* . . . **Bill Orttung** has been named associate professor of chemistry at the University of California, Riverside. . . . **Regis Schultis** has been elected a vice president of Smith Barney in New York where he does financial research on the chemical industry. Outside he is working on his Ph.D. dissertation on synthetic fiber marketing at New York University. . . . **Phil Trussell** has been made an assistant vice president at Cabot, Cabot & Forbes in Boston. . . . **Jerome Vielehr** is still with Coca-Cola in Atlanta and this year is President of the M.I.T. Club of Atlanta.

A last minute telephone conversation reveals that: **Oscar Manley** and others have left American Science and Engineering to set up Visidyne in Woburn, Mass. The firm will specialize in government R and D and information display devices in the fields of astrophysics and ecology. . . . **Bob Malster** has recently been appointed Staff Assistant to the Vice President of Camera Manufacturing at Polaroid. . . . Please note the change of your secretaries' addresses.—Co-Secretaries: **Bruce B. Bredehoft,** P.O. Box 181, Dover, Massachusetts 02030. **T. Guy Spencer, Jr.,** 73 Church St., Weston, Mass. 02193

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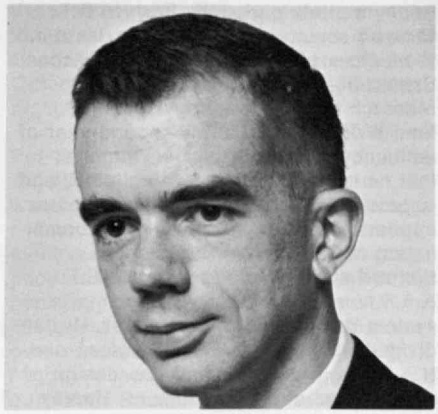
The address at the bottom of the column has changed. Betty and I and our daughter have moved to Helsinki where I am taking over as general manager of Mobil's Finnish affiliate. We'll be here for the next few years and would very much welcome visits from classmates on holiday or business. Remember that this is a convenient stopping point on the way to Russia. . . . Early in the summer we had another pleasant outing with Susan and **Arthur Aznavorian.** We met near Deventer, in Holland, where Betty and I have purchased, and are having restored for use as a vacation spot, an early 18th century hunting lodge. Arthur and Susan brought their "Lechmere" charcoal grill and we had a real American style cookout.

Now from the ole' mailbag: **Julian Cherubini** is now marketing manager of the Equipment Division, Higher Voltage Engineering Corporation in Burlington, Mass. . . . Gindy Manufacturing Corporation, a wholly owned subsidiary of the Budd company, has named **Milton Ginsburg** president. Gindy produces truck trailers and cargo containers. . . . Josephene and **Alan Kotliar** announce the birth of their first child, a son, on March 21. . . . **Peter Sinz** writes: "My wife, Isabelita, and I have three children, a boy age 9 and two girls, ages 6 and 4. I am General Manager of a small company specializing in the sale of pipes, valves, and meters for water distribution —Water Works Suppliers Corporation— with annual sales of $2 million. I also own and operate a small taxi company (3 cabs) and an auto repair shop (4 employees). Please call us if you're in Puerto Rico. We're in the phone book."

Jay Schumuecker is "working at the Jet Propulsion Lab (I've been there since graduating) heading up mechanical activities on the Mariner missions that are being readied for a 1971 launch to Mars to map the Martian surface." . . . **Donald Calabro** has been elected an assistant treasurer of State Mutual Life Assurance Company. Don received his master's degree in business administration from Boston University in 1962 and joined State Mutual that year; he became a securities analyst in 1965. . . . **James Beck** advises us that he received his Ph.D. in mechanical engineering from Michigan State University in 1964 and has been on the staff of M.S.U. since then. He is now an associate professor in mechanical engineering. . . . A recent, long article in the Lowell, Mass., *Sun,* discussed the developments of Tantron, a new company devoted to the design and manufacture of digital signal processing equipment. Tantron's president is **Yohan Cho,** who came to the U.S. from Korea, received both his S.B. and S.M. degrees from Tech. After graduating he worked for Honeywell and then MITRE. He has published extensively and has been awarded several patents, the article notes. Cho lives in Harvard, Mass., and is married with two children. . . . An article, "Detection and Parameter Estimation in an Amplitude-Comparison Monopulse Radar" by **Darrol De Long** and Edward Hofstetter, '55, was published in the *IEEE Transactions on Information Theory.* Darrol has been with Lincoln Lab since graduation. As a staff member there, he works on problems associated with radar signal design and processing.

George Malaney was recently Professor of Sanitary Biology of the Department of Environment and Water Resources Engineering, Vanderbilt University. . . . **Alan Donaldson** writes: "I work for KBI in Bayertown, Pa., where we are building a house. We own one-half of a Mooney Super '21 which we have flown to California, the Bahamas and along the East Coast. My wife has written several aviation articles for *Air Facts* about our exploits." . . . **Frank Salz**'s company in Hartford, Conn.—



William R. Walsh, '57, new assistant to the president of Mobil Oil Corporation. Bill was manager of the pricing and special studies unit of the corporation.

Computer Systems and Education Corporation—was recently written-up extensively in the *Hartford Times.* The firm operates schools for computer programmers in Hartford, Providence and Boston. About 900 students attend the schools. In addition, the company offers a range of computer processing services.

David Lovenvirth has been appointed a regional manager for CEIR, a subsidiary of Control Data. He will be responsible for the area served out of Boston. . . . That's all for now. Please send me all your news. The envelopes will come in handy as fuel for the fire to keep us warm this winter. Interesting snapshots for publication are also welcomed.—**Frederick L. Morefield,** Secretary, Tiirasaarentie 17, Lavttasaari, Helsinki 20, Finland

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The lead-off hitter for this season's notes is **Vic Klemas,** who sent us this note: "In 1969 I will have presented four papers on multispectral imaging at various national and international symposia, including the Sixth International Symposium on Remote Sensing at Ann Arbor, Mich. Most of these papers deal with the multispectral imaging of signals from orbitors and landers utilizing data compression techniques." . . . **James R. French, Jr.,** is working at Jet Propulsion Laboratory in the System Test and Launch Operations Section. He is currently responsible for space craft/ propulsion system integration and systems testing on the Mariner Space Program slated for 1971. . . . Back at M.I.T. completing his master's thesis in political science is **John B. Forrest, Jr.,** after a 4-year hitch in Vietnam. He was promoted to the rank of Major in March 1968 and then spent a year at the Ordnance Officer Career Course at Aberdeen Proving Ground in Maryland during the first year back in the states. His next assignment is expected to be to the U.S. Army Combat Development Command at Fort Belvoir, Va., sometime this fall, probably working on counter-insurgency doctrine.

Beginning this past July, **Edward B. Crowell** assumed duties as an instructor in medicine at the University of Wisconsin School of Medicine. He is also doing research in the hematology section . . . . **Emil Wright** is now in his second year of residency in eye surgery. He reports that he is married, has two children, and is poverty stricken—the latter symptom appears to be the result of some combination of the other circumstances. . . . **Richard Clafter** received an A.S.E.E.-N.A.S.A. summer faculty fellowship in system design this past summer. He divided his time between Stanford and N.A.S.A. while working on the design of a commuter airline system . . . **Harvey Willson** has recently been named manager of technical services for Systemation, Inc., in Boston, a consulting firm specializing in information systems for university administration, government, and manufacturing firms . . . While Harvey is going into consulting, **Charles Leonard** is going out—he left the consulting field to help form Meadowbrook Systems, Inc., in New York City. Meadowbrook specializes in the development and marketing of instrumentation and related supply items to the life sciences markets.

Christopher Hahn sends word that: "I have recently been transferred from Shell Chemical offices in New York City to the Princeton, N.J. production facility where the *No Pest* insect repellent strips are made. My current position here is manager of the Technical Department."

Robert Schwartz sent the following note—but no cigar: "Not much news, but for those who attended the reunion and are curious, my wife had a girl later on that summer, on August 9. At this time, the baby, Bethany Lynn, hasn't learned to talk and therefore hasn't voiced any opinion as to whether she is interested in attending Tech." . . . Also during the summer of 1968, a daughter arrived for the **Thomas McClimans,** whom they named Else Leona.

Ed Newton is manager of new product development control at the Gleasonworks and also spends time on the Rochester M.I.T. Educational Council. Ed reports that they have just bought a larger home fairly close to their previous location so visitors to the Newton's should check their address. . . . **Peter Greven** was married on July 21, 1968, to the former Mary Lucas of Elmira, N.Y., and they are now living in Waltham, Mass. . . . **Fred Whittington** received his Ph.D. from Louisiana State University last June and is now assistant professor of business administration at Emory University in Atlanta, Ga. . . . If any of you are down in Washington, D.C., be sure and stop in at The Store, Limited, in Georgetown, which has been started by **Dick Stauffer** and a partner. They carry a very exciting collection of contemporary furniture, fabrics, home furnishings and a variety of other odds and ends.—**Michael E. Brose,** Secretary, 199 Sudbury Rd., Concord, Mass., 01742; **Antonia D. Schuman,** 22400 Napa St., Canoga Park, Calif. 91304

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Welcome to Volume 72 of the *Review* and the 10th anniversary of the first appearance of the '59 numerals in the class notes. This decade has seen the world around us change with startling celerity and not to be left behind, our Class has followed suit. This fact was vividly brought out during the description of "Mr. Average Fifty-Niner" which highlighted the reunion banquet at beautiful Wentworth-by-the-Sea. The following statistics are preliminary high points from the distributed questionnaire, while a full report of the reunion and survey will have to wait until the next issue. The major item of class business was the election of class officers to serve for the next five years. **Gerry Stephenson** handed over the president's gavel to **Al Bufferd,** who did an outstanding job as reunion chairman. **Jerry Welch** was elected vice president and **Chuck Staples** was entrusted with the key to the class piggy bank. **Lloyd Howells** was given the responsibility of organizing the 15th reunion and **Dick Sampson** and **Pat McGovern** were elected Class Agent and Alumni Council Representative respectively. Without quite knowing why, and without fully considering the work involved, I accepted the position of class scribe. Our thanks go out to the old slate of class officers for their efforts in our behalf, with a special note of appreciation to **Glenn Zeiders,** whose contributions to this column for the past five years have been greatly enjoyed.

Class Survey—**Al Bufferd** received 242 responses to the questionnaire mailed out to over 700 of our classmates. I have gone back into the archives to resurrect the five-year results which provide an interesting comparison with the current ten-year figures. The results shape up as follows:

	5 year results	10 year results
Percent working in the same field	83	62.5
Number of employers since graduation	1.7	2.1 (High 13)
Annual salary:		
Starting	$6,300	$7,100
Current	$10,200	$17,300 (High $50,000)
Vacation weeks per year	2.55	3.4
Military service	32%	30%
Percent married	72	87
Number of years	3.8	7.3 (High 19)
Average number of children	0.85	2.2
Average age	2.2	6.0
Housing:		
Percent renting	76	33
Average rent	$121	$180 (High $425)
Percent owning	34	67
Average price	$18,000	$32,000 (High $68,000)

Of the 242 responses, only 19 of our classmates smoked "pot," while only 1 had any exposure to LSD. A little over 20% of us have at one time or other sported chin whiskers, while only a little more than 11% of us have participated in any organized social protest. (Ah yes, the silent generation!) Next issue I'll report more of the interesting details of this fascinating study, and also report in greater depth on the reunion.

David Brahm writes that he is now working for the Aircraft Engine Group of the General Electric Company in Lynn, Mass., as a systems analysis engineer and living in Peabody with his lovely wife and 6-year-old son David. . . . Major **George Connor** informs us that he is currently Deputy Commander of the Nuclear Defense Laboratory at Edgewood Arsenal, Md. . . . **Dick Desper** sent along the following note: "Bea and I have been taking in foster children. Our first one, Maria, was adopted last February after we had kept her three months. We now have a Negro infant, Scotty, aged four months. Betty Anne, the oldest of our four children by birth, will start kindergarten this September. Needless to say, we both like kids." Amen! . . . **Neal DesRuisseau,** after working for five years at General Motors Corporation, returned to academic life receiving his M.S. in 1967 and Ph.D. in 1968 (mechanical engineering) at the University of Cincinnati where he is currently on the staff as Assistant Professor.

A fellow Course III classmate, **Owen Devereux** also returned to the academic clime after having worked for several years for Chevron Research on the West Coast. Owen is currently an Associate Professor in the newly formed Metallurgy Department at the University of Connecticut. . . . **Ellery Stone** has joined the increasing list of 59'ers who have ventured into the securities field. He is presently

a chemical industry analyst for the Fidelity Management and Research Company in Boston. . . . **Steve Parkoff** writes: "I have recently joined the M. Loeb Corporation, as Vice President and General Manager of the Washington Division. The company specializes in wholesale food distribution, a new industry for me. Barbara and I, and our two children are living in Silver Springs, Md., awaiting the arrival of our third child." I ran into **Barry Weinberg** in New York City this summer and he filled me in on the progress of the recently formed Channing, Rothbard and Weinberg, Inc. Barry is president of the less-than-year old New York firm whose major function is providing capital for new as well as existing companies active in technology-oriented fields. Any of you interested in starting your own company might want to contact him. . . . I ran into **Jack Pogarian,** at, of all things, an Armenian wedding last month (Where else!) and he informed me of his new position as vice president and general manager of Sanford Process Corporation, in Natick, Mass.

A rash of press releases have been received announcing the continued success of many of our classmates. Among them is **Bruce Blomstrom** named Assistant to the President of Libby, McNeill and Libby, the Chicago-based worldwide food processor and marketer. Prior to joining Libby's, Bruce served as Assistant Secretary in the Ministry of Commerce and Industry, Uganda in the M.I.T. Fellows in Africa program. EG&G announced the promotion of **Neil Bernstein** to Product Sales Manager for its Silicon Photodiodes and Light Instrumentation Product lines. Prior to joining EG&G, Neil worked for Clevite Semiconductors Division. . . . **Martin Schiff** has been appointed General Manager of the Indikon Company of Watertown, Mass. Indikon specializes in supervisory instrumentation used on high speed turbines and compressors for the automotive, marine, oil, and stationary power industries. . . . The Executive Committee of the M.I.T. Corporation announced promotion to Associate Professor for three of our classmates. They are: **Richard Briggs** and **Alan Oppenheim** in the Department of Electrical Engineering and **Fred Wan** in the mathematics department.

It is with deep regret that I report the death of one of our classmates, **Ken Fink,** on June 17 of this year. Ken was a graduate of Course XVI and was living in Santa Monica, Calif. at the time of his death.

Well that completes my first column as your Class Secretary; only 49 to go. And, in the words of a great old philosopher, "Keep those cards and letters coming in folks."—**Arthur J. Collias,** Secretary, Technical Forum Associates, Inc., 545 Technology Square, Cambridge, Mass. 02139

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I have lots of news, but haven't even had time to read through all the cards and letters. But, I've just finished reading the *Harvard Business School Bulletin* (their alumni magazine) and found something there which I think you will all enjoy. This was written by Joel Schiavone, owner and operator of Your Father's Mustache in New York City; Joel is secretary for the M.B.A. Class of 1961 at the Business School. It's reproduced here exactly as it appeared in the July/August 1969 issue of the Bulletin:

"The Alumni Fund contacted me several months ago and asked me to develop a new approach to fund raising, suggesting that they needed more punch in their message. The following is a condensed version of our correspondence.
"Sample: Dear—, If you don't give any money this year, someone will come down and punch you in the nose.
"Alumni Fund: This is a little too direct. Can we have something with more sensitivity?
"Dear Mr. —, If you don't give any money this year, someone will be down and scratch your eyes out.
"A.F.: Still on the wrong track. Can we have something appealing to old school ties?
"Dear ——, If you don't give any money this year, someone will come down and strangle you with an old school tie.
"A.F.: Not quite what we had in mind. Something more directed at increased costs.
"Dear —, If you don't give any money this year, someone will come down on the subway and punch you in the nose.
"What about something that appeals to the older alumni?
"Dear Mr. —, If you don't give any money this year, someone will jog down and punch you in the nose.
"Still a little too hard sell. Can't you think of something that is not so direct an appeal for money?
"Dear —, Someone is coming down to punch you in the nose if you don't give any money this year.
"I think we're on the wrong track. You should emphasize increased alumni responsibility.
"Dear —, If you don't give any money this year, someone will come down and punch you in the nose and it won't be our responsibility.
"Frankly this is getting us nowhere. We would suggest a totally new approach.
"Dear Alumni Fund, If you send me any more letters I will personally come down and punch you in the nose."

On to other matters: **Tom Farquhar,** our intrepid Tenth Reunion Chairman, has all kinds of information to transmit. The reunion will be June 12, 13 and 14, 1970, at The Jug End in South Egremont, Mass. That's near the Massachusetts/Connecticut/New York junction, so should be convenient for lots of people. So far we have two Regional Chairmen (an undefined but absolutely critical position); they are **Gerry Hurst** for Philadelphia and **Noel Bartlett** for Cleveland. Anyone else with delusions of grandeur who wants a similar title should call or write Tom (52 Mayo Rd., Wellesley, Mass.) or me and we will dub you with whatever title you'd like to have and put you to work. Reunion Committee meetings will start early in October, so call if you want to come to any of those.

Put the date on your calendar—June 12-14, 1970—and get out the covered wagons, etc., in preparation for the trip. I have rounded up all the leftover mementos from our other gatherings: grey poodles left over from Junior Prom, 1959, beer mugs inventoried after Senior Week, 1960, and Class of 1960 playing cards over-ordered at our fifth reunion. Any suggestions for what won't be used up at our Tenth Reunion will be eagerly accepted.

Next month I'll have reams of news about members of the Class who have written in about their life and hard times. Add yours to my ever-growing set of background material for the all-time great novel by writing to—**Linda G. Sprague,** Secretary, 10 Acorn St., Cambridge, Mass. 02139

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John Baxter writes: "In January and February of 1969 I attended the Al Somers School for Umpires in Daytona Beach, Fla. On May 21, 1969 I arrived in Florida to begin work as an umpire in the Florida State Baseball League. I will be here through August. As this is written I have had three games here in the league." Weird! Is someone pulling the secretary's leg?

More believable was **Mike Pearlman**'s card: "I was a member of the Canadian expedition 'Project North Pole 1969' and lived in an ice camp at the Pole from 9 April to 4 May. This is a follow up to a 1967 expedition when we reached the pole on 5 May, 1967, and was planned as an extensive scientific project. I was in charge of all oceanographic and sonar work for which Ocean Research Equipment built special arctic equipment."

In a substantially hotter spot is **David Gross** who is the Deputy Director of the New York City Bureau of the Budget. He must really suffer! There are two younger Grosses—Ben (10) and Jan (7). David is also on the M.I.T. Visiting Committee for Architecture and Planning.

Bonnie and **Harry Baya** had their first child, Matthew Joseph Baya, on Washington's Birthday this year which gives Matthew a goal to aim at. Harry continues working for Irwin Management Co., in Columbus, Ind. He studies mutual funds and other such things, none of which I understand. He is also a song and dance man. The local version of the Music Man had Harry as the lead. Nonbelievers can check with **Terry Langendoen** who caught one of the performances. . . . Late last year John Vickery was born to Joan and **Robert Vickery.** Bob has spent life since June, 1961, working for McDonnell Douglas Astronautics in Santa Monica; he is now a supervisor performing systems effectiveness work. . . . The **Paul**

Robertsons adopted a little 4-week-old boy last January and named him Paul Timothy Robertson, Jr., but he goes by the name Timmy.

The most common element of any letter or card I get these days is a listing of children. The old days of maiden names of new brides and their colleges is nearly over. I do get a few though. The former Elizabeth Van Arnam, of Northville, N.Y., who is a teacher at the Perkins School for the Blind in Watertown, Mass., married one **Bernard Lech** on July 20, 1968. Her husband is a senior analyst for the System Development Corp., in Lexington and he will be a full-time student at M.I.T.'s Sloan School this fall. . . . **Richard Miller**'s card is a tie between past and present. He provides us with his wife Nancy's maiden name (Solander) *and* the list of children: Julie (4) and Sara (2). Dick has been the Manager of Operations Analysis for Avisun Corp., since late 1967. The Millers live in Newtown Square, Pa. . . . The **Paul Davises** list: The former Judith Page (Wellesley), Ann (September, 1961), John (September, 1963) and Robert (January, 1966). That out of the way he goes on to say: "I received a Ph.D. in electrical engineering from Lehigh U. in October 1968. I am presently working at Bell Telephone Labs in Reading, Pa., designing integrated circuits (including some for the Picturephone)."

Also at Bell Labs is **Harry Garing** who is working on "companywide computerized business information system (the BIS Project)." Sounds sinister. . . . **Alvin Klancnik** has two children: Mike and Steve. Alvin left the Baltimore Plant of Procter and Gamble last December and became the General Manager of the Hi-Lo Corp., of Chicago. They live right under the flight path for O'Hare Airport in Park Ridge. . . . **Richard Lowe** has two baby daughters but, for a switch, doesn't list them. The 4 Lowes "enjoy a single family detached house open all year around, high in a leafy, rainy Honolulu valley." Rich works with a land owner redeveloping a 70-acre tract. He also does civic work and consulting. . . . **Glenn Stoops** says that his son, Glenn, was a year old on May 11. . . . The big excitement of the last year for **Don Straffin** was when his wife, Pat, broke her leg skiing on February 16. Who knows what will turn you on. Two days later he changed jobs and is now at American Variable Annuity Life. . . . Doctor **Robert Telfer** is starting a residency to specialize in neurology at the Neurological Institute in New York.

Lieutenant **Denis Du Bois** is "still in the Navy. Now in Singapore as Officer in Charge of the Navy's Ship Repair Program here. A far cry from Course III, but really enjoying it." . . . **Si Schwartz** works at Hughes Aircraft in the Electron Dynamics Division; he is in ion laser development. . . . **Philip Huang** got a Ph.D from the University of Maryland this year in Physics and is now a Research Associate in the same department. . . . **Joe Harrington** is on the move again. This time Illinois Edison is loaning him to United Nuclear Corp., in Elmsford, N.Y., for about a year "to the mutual benefit of all concerned, presumably." . . . **Curt Hartwig** sent me a copy of an article about some work **Don N. Graham** has been doing. Don and three friends started up Computer Signal Processors about a year and half ago in Burlington, Mass. The company is puttting out an inexpensive, but large capacity fast Fourier analyzer. Lots of interesting applications, such as oil exploration, were mentioned in the article.

Another classmate in business for himself is **Robert Gustafson.** He is also in the computer game but on the software end. The company is Argus Engineering, Inc., in Elmhurst, Ill. It specializes in "dynamic system simulation and control." Patronize your local classmate.—**Andrew Braun,** Secretary, 131 Freeman St., Brookline, Mass. 02146

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This the first issue after a hopefully glorious summer for all of you. I hope to hear directly from many of you this year as I'm certain there have been many marriages, job changes, and new children which haven't yet been reported—just drop me a postcard.

Richard Queeney is teaching in the Department of Engineering Mechanics at Penn State, and has recently built a home a few blocks from campus. . . . Lieutenant **Michael Terry** has graduated with an M.S. in mechanical engineering and a naval engineering degree from the Department of Naval Architecture and Marine Engineering at M.I.T. He is working at the Naval Ship Research and Development Center. . . . **Rudolph Gawron, Jr.,** has taken a position as Specialist-Materials Systems, with G.E.'s Color Television Department in Syracuse, N.Y. He and his wife bought a house recently. . . . **Lawrence Sher** is now an Aerospace Engineer at N.A.S.A.'s Electronics Research Center in Arlington, Mass. He is working on error studies of strapdown inertial navigation systems and conducting flight angular vibration experiments.

Richard B. Anderson is currently an Ed.D. candidate in research methodology at Harvard Graduate School of Education. . . . **Frank McMullen** has retired from active duty in the U.S.A.F. and is working for LTV Aerospace Corp., in Dallas, Texas, as project engineer in applied research and development. . . . **John McCloskey** is employed as a research fellow in metallurgy at Mellon Institute. He and his wife have a daughter, Marya, 20 months old. . . . **Erik Pedersen** married the former Margaret Sawyer, a graduate of the University of Massachusetts, in 1964 and, after spending a couple of years in Canada, returned to M.I.T. and obtained a masters degree in Industrial Management. He is now General Manager of the Data Systems Division of Canberra Industries in Meriden, Conn. He and Margaret have a son, David, one year old. **Herschel Clopper** completed his Ph.D. work at Rice University in March, 1967, and started in the Plastics Department, R&D Division, E.I. du Pont de Nemours. He has now transferred to the Fluorocarbons Division of the Plastics Department. Herschel and Phyllis have two children, Staci Rachel, four and one-half, and Jeffrey Scott, two. . . . **June L. Matthews** is on a postdoctoral fellowship studying nuclear physics in the Kelvin Laboratory, East Kilbride, Glasgow, Scotland. . . . **Frank Rubin** is married and has two children, Eric, 4, and Laurel, 2. He is working as a senior associate programmer at I.B.M. in Poughkeepsie, N.Y. He obtained an M.S. in mathematics from Brandeis University and is working towards a Ph.D. from Syracuse University. . . . **Thomas Mantei** is doing postdoctoral work at the University of Paris. . . . **Bostwick Wyman,** Ph.D., is Assistant Professor of Mathematics at Stanford University.

R. Brian Strong and his wife Nancy announced the birth of their first child, Robert Brian, Jr., on March 24, 1969. He writes that Dave Mehlin, '63, and Norm Dorf, '63, are both now prosperous architects in New York City. . . . The new President of Loyola University in Los Angeles is **Donald Merrifield,** who obtained his Ph.D. from M.I.T. in 1962. He was formerly Assistant Professor of Physics at the University of San Francisco. . . . Captain **Neil Weatherbie** has been assigned to the Communications Squadron (A.F.C.S.) at Tinker Air Force Base, Oklahoma, as Officer in Charge of the Tinker Automatic Switching Center of the Defense Communications System Automatic Digital Network.

B. G. Brown, of Johns Hopkins University in Baltimore, is on a Johns Hopkins-Westinghouse research team under a research contract from the National Heart Institute's Artificial Heart Program. They recently reported on an intra-aortic "triple-balloon" heart assist device at a recent conference. This device has a unique capability for increasing coronary occlusions, thereby restoring strength to the failing heart muscle. . . . At M.I.T., **Jonathan Green** was promoted from instructor to assistant professor in architecture and **Stephen Kukolich** was named assistant professor in chemistry. . . . **Michael Terry** received the William L. Stewart, Jr. Award at a recent M.I.T. convocation. . . . The Alfred P. Sloan foundation has named **Kenneth A. Klivington,** neuroscientist and electrical engineer of Fisher Jackson Associates, to the position of program associate.

Harold B. Shukovsky, a physical metallurgist, has joined the research staff of R.C.A. Laboratories at the David Sarnoff Research Center in Princeton. He received a B.S. in physical metallurgy in 1962, an M.S. in 1964 and an Sc.D. in 1965, all from M.I.T. Since 1965, Mr. Shukovsky has been on the staff of the Western Electric Research Center in Princeton. In his new assignement at R.C.A. Laboratories, he will be a member of the magnetic memories research

group of the Data Processing Applied Research Laboratory. He is a member of the American Physical Society, the Institute of Electrical and Electronics Engineers, Tau Beta Pi and Sigma Xi. Dr. Shukovsky, his wife, son and daughter live at 48 Merion Place in Lawrenceville, N.J.

Randall Kunz, with Humble Oil and Refining Co., as an Analyst in the Business Service Division and later as Business Analysis Section Head, now holds a new position, Business Analyst, in the controller's department of Esso Chemical Company, Inc., New York. In this new position, he will be responsible for interpreting the world-wide financial performance of a group of product lines within the chemical business. Mr. Kunz received his B.S. and M.S. degrees in Industrial Management from M.I.T. where he served as Treasurer of Tau Beta Pi, an honorary fraternity. He resides with his wife, the former Elizabeth Ham, and their two daughters, Veronica and Caroline, at 2143 Old Raritan Rd., Scotch Plains, N.J. . . . **Richard A. Crowell,** has been elected Vice President of The Boston Company, Inc. Richard received an S.B. in 1962, an M.S. in 1964, and a Ph.D. in 1967, all from M.I.T.

D. E. Thornhill is the author of *An Integrated Hardware-Software System for Computer Graphics In Time-Sharing,* a document prepared for the Air Force and Advanced Research Projects Agency, published in December, 1968.

Edwin A. Carlson has been appointed assistant systems director in the data processing department at The Travelers Insurance Companies, Hartford, Conn. Mr. Carlson joined the company in 1963 as an actuarial student, was promoted to actuarial analyst later that same year, to actuarial assistant in 1964 and to assistant actuary in 1967. He is a Fellow in the Casualty Actuarial Society and a member of The American Academy of Actuaries. A native of New Britain, Conn., Mr. Carlson lives in Springfield, Mass. . . . **Harvey E. Cline,** a metallurgist at the General Electric Research and Development Center, has received an award from the New England Regional Conference of the American Institute of Mining, Metallurgical, and Petroleum Engineers (A.I.M.E.) for writing the most outstanding technical paper published by the organization in 1968. The award—given annually to an author or authors residing in New England or Upstate New York—was presented to Mr. Cline at the New England Regional Conference Meeting held in Boston, for his paper, *Theory of the Lamellar Dendritic Transition in Eutectic Alloys,* which provides a definitive explanation of the microstructures resulting from the solidification of eutectic alloys. It was published in the Transactions of the Metallurgical Society of the A.I.M.E. last year. Mr. Cline has specialized in the studies of eutectics, mechanical properties, composites, and directional solidification, since joining G.E.'s Research and Development Center in late 1965. He received his M.S. and Ph.D. degrees from M.I.T. where he also served as laboratory assistant and research associate for seven years. The Clines and their two sons live in Schenectady, N. Y.

Gerald L. Gottlieb, who received his B.S. in 1962 and M.S. in 1964 from the Department of Electrical Engineering, recently co-authored an article published in the *I.E.E.E. Transactions,* "Stretch Receptor Models I-Single-Efferent, Single-Afferent Innervation." From 1962 to 1964, he was a Research and Teaching Assistant in electrical engineering at M.I.T. From 1964 to 1966, he worked as a research and development engineer for Philco Corp., Newport Beach, Calif. Since 1966, he has been a graduate student at the University of Illinois, Medical Center, Department of Physiology, and since 1967, an Instructor of Information Engineering at the University of Illinois at Chicago Circle Campus. His major research interests are in the investigation and modeling of physiological systems and control theory. . . . **Murray Sachs,** who I hear is now happily married, works at the U.S. Navy Underwater Sound Laboratory at Fort Trumbull, Conn. . . . **James Peterson** is with the Southwest Bell Telephone Co. in Topeka, Kansas. . . . Side note—if I understood one-tenth of what I write about in these columns, I'd be brilliant.—**Gerald L. Katell,** Secretary, 310 Hoge Bldg., Seattle, Wash. 98104

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Our first class reunion was held June 12 through 14 at the Red Jacket Beach Motor Inn, a beautiful new motel on Cape Cod near Hyannis. The first of approximately 35 classmates attending the reunion, together with wives, girlfriends, etc., began arriving Friday evening at the motel. Hot hors d'oeuvres, movies, and music greeted the arrivals, as well as a heated indoor swimming pool. Saturday was an informal day; many went into the nearby towns, swam in the indoor pool, renewed acquaintances, etc. The weather was a little too cool and windy for all but the polar bears to venture into the ocean or outdoor pool.

Saturday evening was the highlight of the weekend with a charter cruise on the *Menensha,* a daytime ferry boat. Included with the cruise were a live band, an excellent buffet dinner featuring Steamship Roast, and a bar. Many enjoyed a tour of the wheelhouse complete with radar.

Our "class meeting" was held on board somewhere between the bar and buffet table. Many claim the meeting was run by a railroad company. **Dick Carpenter,** a stalwart member of the Reunion Committee, was unanimously elected president of the Class for the next five years. **Bob Blumberg** was similarly choo-chooed as vice president, and **Jim Giffin** as class agent. Yours truly was re-elected secretary-treasurer by default. The ponderous meeting lasted until the ten minute band break ended. The entertainment continued until the boat finally docked around midnight.

Sunday was a leisurely day of swimming, saying goodbye, and looking forward to the next reunion. All in all, it was a wonderful weekend thoroughly enjoyed by those attending. Special thanks are due the hardworking Reunion Committee chaired by **Bob Scott,** with **Dick Carpenter, Chip Hatfield, Bob Popadic, Dave Saul,** and **Fred Silverstein** who made the weekend possible. For those 860 of you who didn't attend, mark your calendars now for our next reunion in June of 1974.

Following the reunion, a few classmates went on to Alumni Day at M.I.T. on Monday. Those registered included Edward Casper, Rino Di Bartolo, Ron Gilman, Judah Landau, Bernard Morris, and Martha Harper Redi.

For the first time in five years, I find myself embarrassed with the flood of news available for this issue. I have notes from everyone at the reunion, numerous letters written to the Reunion Committee by those who could not attend, several letters in the "Class Hero" category, partial results of a class survey taken by the committee, news clippings, and notes from the back of alumni fund envelopes. Since I cannot possibly put all of this in one issue, I will be spreading the news over the next several months. As per my past practice, however, all those writing direct letters to the secretary will be honored as Class Heroes and their news will be placed in the next available issue. Please note that my deadlines are usually six weeks before the date of publication of the *Review* issue.

Also please note my new address below. Betsy (BU '66), Laura (daughter, 1968), Sandwick of Gilmanor (shetland sheepdog, 1968), and I will have made the big hop from apartment dwelling to a three-bedroom home in Memphis by the time this issue is published. Betsy and I hope that any classmates traveling through this area will give us a call.

And now to begin with the news from our Class Heroes: **Edward Casper** and his wife Gail were among those attending the reunion. He writes to say that he is doing postdoctoral work in organic chemistry at Yeshiva University; Gail is attending Manhattan Community College working toward an associate degree, and is also working part-time in the library at Columbia University. . . . **Ron Frashure** entered the Navy O.C.S. in 1965, and was in short order condemned to shore duty in Puerto Rico with his little Mustang for two years. Upon exiting as a Lieutenant in September of 1968, he entered Harvard business school. He is now in his second year, after being selected for one of two Fredrick Roe Fellowships awarded to "students of outstanding character who are preparing for a career in finance and who have shown exceptional academic ability in their first year of studies." This past summer he enjoyed Fun City as a bachelor while working at the Chase Manhattan Bank.

Doug Hoylman received his Ph.D. in math from the University of Arizona this past May, and his first paper is soon to be published in the *Bulletin of the A.M.S.* He began teaching in September at St. Peter's College in Jersey City, N.J. as an assistant professor of mathematics. . . . **Jerry Luebbers** has accepted a partnership with a Los Angeles firm of Curran & Co. The firm is in the business of developing and managing real property in California. Jerry expressed regret at not being able to attend the reunion due to his recent involvement in "career shifting."

Bernard Morris received his Ph.D. in solid state physics this past June at Brown University. While in residence there he married the former Anne Rafkind (B.U. '66) and became the father of Suzanne Elizabeth in January of this year. He is now working at the N.A.S.A. Electronics Research Center in Cambridge. . . . **Steve Schlosser** is working for R.C.A. in Burlington, Mass., as a systems engineer. His particular work involves military test equipment. Steve's wife Marlene is expecting their first child by the time this issue arrives. They were both among those attending the reunion in June. Steve wrote to enclose a clipping from the *Boston Herald* announcing the marriage this past August of **Len Theran** to Miss Susan Fargotstein. They were married in Memphis, honeymooned in Hawaii, and will be living in Scottsdale, Ariz. . . . **Al Teich** received his Ph.D. in political science this past June from M.I.T. In February his wife Carolyn gave birth to Mitchell Craig, their first child. Al is now working for the Policy Institute of the Syracuse University Research Corp., and is teaching a course there in political science.

The remainder of this month's news comes from several reunion attendees: **Mark Ain** and his wife Enid were married this past February. Mark is director of the sales training program for Digital Equipment Corp., in Maynard, Mass. After living in Fun City, the Ains have become adjusted to country living on a 300-acre farm in Concord. Mark has learned to drive a tractor and has planted two acres of corn himself . . . **Mike Auerbach** is working on his Ph.D. in chemistry at Cornell and is a consultant for the analytical services division of Monsanto. His wife Sandy, formerly a fourth grade teacher, is now fully employed taking care of six-month-old Dave.

Jim Bradley is at Rochester University working on his Ph.D. in mathematics after two years in the Peace Corps. He is also teaching and enjoying his bachelorhood. . . . **Dick Carpenter,** our new class president, is pursuing his Ph.D. in E.E. at M.I.T. He has also formed Index Systems, Inc., a computer consulting firm for banks and other financial institutions. Two of the other three co-founders are fellow classmates Jerry Burnett and Fred Laconi. Dick and his wife Joanne are living in Belmont. . . . **Tom Cheek** and his wife, the former Susan Hanessian, were married in June of 1967. Tom is now vice president in charge of engineering with Computer Displays, Inc., in Waltham. He and two other M.I.T. alumni started the firm in March of 1968. It has grown to 34 employees and had one million dollars in sales this year. . . . **Steve Glassman,** outgoing class president, is a technology utilization officer at N.A.S.A. headquarters. He is licensed to practice before the Patent Office and by the time of this issue before the New York Bar. The only license he is trying to avoid is one called a marriage license.

Chip Hatfield expects his Ph.D. in E.E. at M.I.T. within a year. In the meantime, he continues his teaching activities there.

Ron Lawson and his wife Jane are both working at MITRE, he on digital systems and she as a programmer. They met at work and were married May 11, 1968. Ron has an M.S. in E.E. from Northeastern, and is working on another M.S. in physics there. . . . **Mike Monsler** received his Ph.D. in aero and astro at M.I.T. this past June. He is now working at the Avco-Everett Research Lab on gas lasers. His wife Barbara (Wellesley '65) gave birth to their first child Eric on March 5 of this year. . . . **Bill Nelson** is an engineering group leader making orthopedic casts for Johnson & Johnson. Bill is living in New Jersey with his wife Joyce and their six-year-old son Chip.

Bob Popadic and his wife Karen met on a sailboat in Chesapeake Bay while Bob was in the Navy. They were married in June of 1968. Bob is now a department manager of the computer services branch of the State Street Bank. . . . **Larry Rabiner** is with Bell Labs working in the field of digital programming. Between graduation and today he received his Ph.D. in E.E. at M.I.T. in 1967, and met his wife Suzanne. . . . **Ron Randall** is in New York City as manager of business planning for Westington Learning Corp. The corporation publishes a computer based index for all educational materials.

Dave Saul and his wife Sue are now living in Wayland, Mass. and they both work for I.B.M. in Cambridge. Harvard University is Sue's client and MITRE is Dave's. . . . **Bull Schipul** is at the University of Syracuse working on his Ph.D. He hopes he will have the degree by January.

Bill Siegmann and his wife Nancy met in Pittsburgh and were married in 1965. Bill received his Ph.D. at M.I.T. in September of 1968, and is now doing postdoctoral work in applied mathematics at Johns Hopkins. Bill and Nancy live in Baltimore with their three-year-old daughter Lisa.

Len Theran, who as I earlier mentioned was married in August to Susan Fargotstein, is in Phoenix to set up a sales office for the Boston-based Teradyne Corporation.

And that's enough news for this month. Let me hear from you.—**Ron Gilman,** Secretary, 5209 Peg Lane, Memphis, Tenn. 38117

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Let me lead off this year's column with what will be the first of a series of progress reports on our forthcoming class reunion. Has it really been five years already? The reunion will be next June and a committee has been working out the preliminary details over the summer. **Steve Lipner** is the chairman, **Dick Schmalensee** is handling the publicity, **Marsh Fisher** is in charge of the site selection, **Jim Larsen** is doing the programming and **Carol Van Aken** is handling the bookkeeping. Soon the cry will go out for more volunteers. Ideas, suggestions, or questions should be sent to Steve Lipner, 75A Marion Rd., Watertown, Mass. 02172

Now to the class news culled from the increasing number of notes and letters. Thank you! **Cliff Weinstein** finished his Ph.D. in E.E. at M.I.T. and has joined the staff of Lincoln Labs. On September 1, Cliff will be married to the former Miss Georgia Green. Georgia is a Cornell alumna from Great Neck, N.Y., who is currently working on a Ph.D. in chemistry at M.I.T. . . . **Dick Nathan** received his Ph.D. in organic chemistry from Brooklyn Polytech and is now working at Polaroid's Chemical Development Department in Cambridge. . . . **J. D. Roach** co-authored an article on capital budgeting which appeared in the April issue of *Financial Executive.*

Barry Wessler presented a paper on computer graphics at the Computers and Communications Conference in Rome, N.Y. . . . Dave Carrier, '66, finished up his Ph.D. at M.I.T. and is now an aerospace technologist at the Houston Spacecraft Center. He participated in recent Apollo 11 flight control. . . . **Bob Morgan** has graduated with honors from the Defense Information School's information officer course at Fort Benjamin, Harrison, Ind. . . . **Richard Rudzinski** received his Master of Arts in Teaching at Wesleyan University this past June. . . . **Jim Bochnowski** graduated from the Harvard Business School with Distinction.

Jim MacMillan graduated from Case-Western Reserve School of Medicine and will continue training in surgery at the University of Colorado. . . . **Dave Cook** finished up at the University of Chicago School of Medicine and will also be going out to the University of Colorado Medical Center this fall. . . . **Dick Pigossi** is working as an economist with Development and Resources Corporation in New York City—working out postwar industrial development programs for Vietnam. . . . **Lloyd Zellmer** is now a partner in Stevens-Zellmer Associates, a Fresno architectural firm. . . . **Bob Waymost** has graduated from the Albert Einstein College of Medicine and has started internship at New York Medical College—Metropolitan Hospital.

Dave Yuille married the former Miss Kathleen Saito last May in San Francisco. Dave graduated from the University of

Michigan Medical School and will intern in the Army at Letterman General Hospital in San Francisco. . . . **Dick Sherman** is studying for his Ph.D. in theoretical solid state physics at Cal Tech. . . . **Al Haberman** is working on his Ph.D. in molecular biology at Harvard. . . . **Bob Silverstein** reports that son, David, was born last October. . . . **John Groves** was married to the former Miss Karen Morrison in April, 1967. John received his Ph.D. in organic chemistry from Columbia this past June and is now an assistant professor in Chemistry at the University of Michigan.

Ralph Cicerone is planning on completing his Ph.D. work by the end of this year and is devoting the remainder of his efforts to improving university and community relations through the University of Illinois Graduate Students' Association which was founded by Bruce Morrison, '65. . . . **Vinod Jhunjhunwala** and his wife, Prabha, report the birth of a daughter. Vinod is currently managing a cast iron foundry. . . . **Martin Thomas** has been promoted to New Methods Manager at Scott Paper. He reports the birth of his first son, Paul.

As for me, I'm starting my third year with Booz, Allen and Hamilton working out of the Cleveland office as a marketing consultant and managing to see other '65ers on a purely random basis in the course of my travels.—**Jim Wolf,** Secretary, Brigham Rd., Gates Mills, Ohio 44040

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As of this issue, I'll be taking over the writing of this column each month. You can address your comments to me in care of *Technology Review,* Room E19-430, M.I.T., Cambridge, Mass. 02139, to be forwarded, or you can send them to me directly at 24, Horwood Close, Oxford, England OX3-7RF. If you do the latter, send it *airmail* which takes four days, instead of four weeks by first class. Besides, there are no dock strikes with air mail! When you write, please indicate what name or nick-name you wish used in the column (e.g. Dick, Rich, Richard, or Bud).

Since there's a lot of correspondence to catch up on, I'll report it more or less as it comes off the top of the pile. So here goes. As for general characteristics, we have had a lot of marriages, a few babies, many hopeful Ph.D.'s (and a few actual), some people in government, and quite a number in the service of our country. Second Lieutenant **Forrest S. Stoddard** (XVI) married Allison Armstrong of Charlotte, N.C., last November. He is assigned to the Flight Dynamics Lab at Wright-Patterson AFB where he does systems analysis for V/STOL technology. He notes that Dayton is nothing like Boston.

Another Air Force officer stationed at Wright-Patterson is Captain **Larry King** (XVI). Since speaking with his mother about five minutes ago, I have to change my copy *from,* "He has bought a house in Dayton as an investment but still remains single." *to,* "He has just sold his house and married the former Janet Fraser of Dayton on August 3rd." I wonder if there is any correlation between those acts!?

Richard Leonard finished his third year with the Peace Corps as a city planner in Temuco, Chile. He plans to pursue graduate study in this field at either Berkeley or Penn. . . . **Michael Birdsall** has completed two years of Peace Corps service in the Marshall Islands, working on school design and construction. . . . **Tom Scott** has returned from Venezuela after a stint with the Peace Corps and also plans to return to graduate school in city planning. . . . **Richard Levine** married Emily Gottfried in July, 1967, and was presented with a daughter Julia Ann in August, 1968. After receiving his M.A. in government from American University this past June, he joined the 3-year Management Intern Program in the Office of the Secretary of H.E.W.

Daughter Carolyn Diane was born to Susan and **Jack Fuhrer** on 7 June 1969. He is now back at M.I.T. for a Ph.D. after completing two years in the Public Health Service. . . . We understand that **Bob Klein** is also with the U.S. Public Health Service. . . . **Fred Doyle** (XVI) is now stationed at McGuire AFB, N.J. as an aircraft maintenance officer in the Military Airlift Command. He recently returned from Bien Hoa Air Base, Vietnam. . . . Lt. **Bruce Wallace** was awarded the Air Force Commendation Medal for meritorious service with the 13th Air Force Headquarters in the Philippines from April 1967 to July 1968. He is presently stationed at Patrick AFB, Fla., where he expects his captain's bars in January. He says he is still single.

Donald Hansen is a 2nd Lieutenant in the U.S. Air Force and is undergoing pilot training at Webb AFB. . . . Lieutenant **F. H. Hauck** is with Attack-Squadron 35, flying a Grumman A-64 Intruder. . . . **Ray Petit** will be returning to M.I.T. for a 3-year program in Course XIII-A for the Navy. . . . **John Freeman** and Bill Byrd work at the Pentagon for the Assistant Secretary of Defense. . . . **Philip Falcone** has completed a tour of duty in Vietnam and is now a structural engineer for the Wigton-Abbott Corporation in Plainfield, N.J. . . . Word comes from **Tim Carney** in Saigon that **Henry Seltzer** is programming computers there. Tim is still in Saigon, at last report, with the diplomatic corps, and claims he can even use chopsticks left-handed now.

Richard Williams married the former Cynthia Lesher of Orinda, Calif., in September, 1967. After receiving an M.A. in biology from Harvard in June, 1968, he decided to become a medical student at the University of California at San Francisco. . . . **Arlee Reno** is still at the Institute "enjoying the possibilities that M.I.T. may be taking leadership in moving this country in *new* directions." His old roommate Allen Smith is "sold" on California and is doing well at Caltech. . . . **John Macrae** graduated from Harvard Business

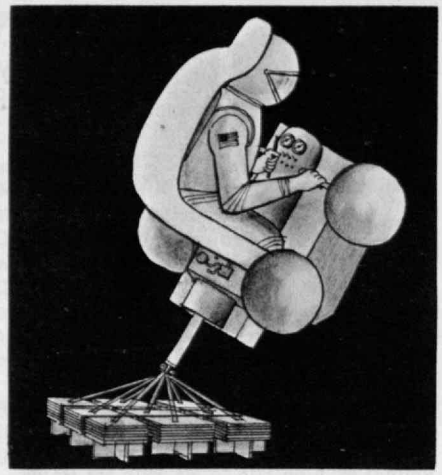
F. S. Stoddard, '66

D. B. Hansen, '66

School in June and is working for Housing Innovations in Roxbury. This developer of low and moderate income housing is headed by Denis Blackett, '60, another M.I.T. graduate. . . . **Henry Goldman** is with the food and Drug Administration in Washington, D.C. He'll be serving there until July, 1970, on a commission in the U.S. Public Health Service. At night he attends Georgetown Law School and hopes to complete his law studies by 1972.

Wilson Tang was married in Hong Kong this summer and is now teaching at the University of Illinois in Urbana. . . . A letter from **Dennis Nagy** informs us that he married a German girl, Dori Meffert, whom he met in Europe last year. They were married this past spring. He is in a Ph.D. program in structural engineering at Berkeley. Dennis informs us that: **Jack Wright** married an R.P.I. coed, Posy O'Niell, last summer and is now employed by Martin-Marietta in Orlando, Fla.; **Thomas B. Jones, Jr.,** married the former Miss Mary Bellamy (Wellesley '67); **John Bobbit** married the former Miss Peggy Coulsen (Wellesley '67) and is in the Air Force in Denver; **Doug Shawhan** married the former Miss Sheri Sproul, and is working toward a Ph.D. in Physics at the University of Chicago. Thanks for the news, Dennis! . . . From **Woody Sullivan** comes some news of old marriages: **Joe Balcewicz, Dave Anderson, Harry Moser,** and **Carl Ellison.** Woody was studying astronomy at the University of Maryland at last report. . . . **Michael Adler** finished Business School at Columbia June '68, then married Marcia Pearl (Barnard '68) in September of 1968. He now is a systems analyst and engineer with Loral Electronic Systems in the Bronx.

Bari Skinner is now the mother of two daughters and lives in Arizona. . . . **Bob Klein** married Marian Lerner June 23, 1968. . . . **Robert Zucker** married Miss Glenda Teal on September 1, 1968 and is presently in a Ph.D. program in Neurological science at Stanford. . . . **Robert Poole** married Marilyn Kinsky June 17, 1968. She works for Geigy Chemicals and he for Sikorsky Aircraft. . . . **Rex Ross** was married on December 23, 1968, to Adrian Turner. They live in Houston where he is associated with Bonner and Moore Associates. . . . Paulette and **Richard Domercq** had a baby girl, Pau-



Bo Pasternack, '66, helped design this lunar pogo stick at Stanford University.

lette Nicole, on December 6, 1968. . . . A girl, Reid Lucile, was born to Mary and **Tom Bush** July 12, 1968.

Judy and **Bud Buttrill** proclaim the arrival of a boy, Sidney Eugene, born March 16, 1969. Buddy will get a Ph.D. in Chemistry from Stanford in January, 1970. . . . **Alan Tobey** married Ruth Jensen (Simmons '68) in June, 1968. . . . **Paul Godfrey,** a third year medical student at the University of Illinois, married Maureen Kelly in June, 1969. . . . Theresa and **Joe Shaffery** have a new son. . . . **Steven** and Donna **Disman** announce the birth of Jessica Wendy, born November 12, 1968. Steven works for the New York City Bureau of the Budget. . . . **Ronald Lundquist** married Marilyn Lloyd on October 5, 1968. The M.I.T. Chapel was the scene of the August 8, 1968 marriage of **Norm Rubin** to Claire Thompson. Norm is presently a University Fellow in Musicology at Princeton. . . . **Peter Young,** now working as a transportation planner with the Southeastern Pennsylvania Transportation Authority, and his wife are the proud parents of a son, Paul Edgar, born October 7, 1968. **John Schneider** and his wife had a second girl, Catherine Clara, October 1, 1968. **Matt Fichtenbaum** married Judy Hargreaves on May 19, 1968. Matt is associated with General Radio.

Now for a few brief notes on degrees and students. **Michael Potash** (X) received his M.S. from Tufts in June. . . . **Yoshiharu Moriwaki** is trying for a Ph.D. in materials science at Caltech on an N.D.E.A. Fellowship. . . . **Pete Blankenship** has just completed his masters studies as part of the Grumman Masters Fellowship Program. Each year 10 outstanding Grumman engineers are selected for this two-year work/study program. . . . Princeton conferred the Ph.D. in chemical engineering upon **Mike Romney** (V) this past June. In 1967 he also received an A.M. from the same institution.

Jim Carroll is studying for a Ph.D. in aeronautics and astronautics at Stanford.

Howard Hutt is doing graduate work at the University of Uppsala, Sweden. . . . **Leonard Levin's** work in air and water pollution is being supported by the Public Health Service. . . . After spending a year in the Aerodynamics Research Group at Douglas Aircraft, **David Wilcox** returned to the campus life at Caltech. He hopes to graduate next June. . . . After earning a masters from Syracuse University in January, 1968, and marrying Joanne Flink (Simmons '68) in July, **Bob Silver** returned to Syracuse where he's now pursuing his Ph.D. in mechanical engineering.

Paul Salipante, Jr., married the former Anne Marie Duckworth in December of 1966 and had a son Jeffrey in May, 1968. He is studying for his Ph.D. in business at the University of Chicago. **Harold** and **Ann** (nee Kazanow) **Dershowitz** were married in June, 1967, and are now both doing graduate work. Harold is studying physical chemistry at Temple, and Anne molecular biology at Penn. . . . **Larry Daley** married Kathleen Shedd on June 21, 1969, and is in the chemical engineering Ph.D. program at Cornell. . . . In Ph.D. programs at Harvard: **Alfred Stone** (physical chemistry) and **Monte Graham** (business). Ph.D. candidates at M.I.T. include **Ted Kaplan, Gervasio Prado,** and **Martin Kaliski** (all in E.E.); **Robert Pindyck,** (economics); at Northwestern: **Dave Liroff** (speech-radio-TV-films) and **Mike Leavitt** (political science); at the University of Chicago: **Don York** (astronomy); at the University of Illinois, Urbana: **Bob Large** (mining metallurgy and petroleum engineering); at the University of Wisconsin: **Stuart Shapiro** (computer sciences); at the University of Pennsylvania: **William Thomas** (economics); at N.Y.U.: **Edward Steinberg** (economics). **William Deitrich** is in an L.L.B./M.B.A. program at Columbia.

Those attending medical school are: **Joe Adolph** (Tufts), **Dan Dedrick** (Yale), **Tom Rice** (Columbia), **Jonathan Hopkins** (Cornell), **Chuck Davis** (Harvard), **Mark Glickstein** (Johns Hopkins), and **Gene Shermann** (North Carolina). Gene attended the Institute of Cardiology in Mexico City as a special student during the fall of 1968. While there, he reports seeing a little bit of the Olympics including the fine showing by the U.S. small boat crews under the direction of M.I.T.'s own Jack Frailey. His wife will be entering medical school this fall at the University of North Carolina; they now reside at 128 Gary Rd., Carrboro, North Carolina 27510.

Michael Marx, Enrico Poggio, Lewis Gains, Roger Rasmussen, Daniel T. Allen, William R. Schnicke, and the **John Esterls** sent in brief notes regarding our Class's lack of columns last year. . . . **Rod Edwards** is directing a series of model tests of ice breaking vessels at the Naval Undersea R & D Center in San Diego for the Coast Guard Office of Engineering. . . . **Roy Poust** (Sloan) is in the Navy serving as director of the U.S. Naval Academy's Computing Center. . . . Lieutenant j.g. **William Moss** (III) is a math and physics instructor at the Naval Nuclear Power School, Bainbridge, Md., simultaneously working on his Ph.D. in applied math at the University of Delaware. . . . Lieutenant Commander **W. H. Stillwell** (XVI) served as weapons officer in a guided missile destroyer after graduation. Following eight months in Vietnam and the Sea of Japan with the Pueblo problem, he spent a year as a student at the Naval War College in Newport, R.I. Now he is teaching weapon systems and computer applications at the Naval Academy.

Each year M.I.T.'s Department of Electrical Engineering presents several awards of $500 each for excellence in teaching. Of 1969's seven awards, no less than four were received by members of the Class of 1966. **Paul Demko** is working for a Ph.D. in communications biophysics while holding an N.I.H. Fellowship. He received his S.M. in 1968. **Stu Madnick** (see above). **Fred Centanni** is studying for his S.M. and E.E., with emphasis in electrohydrodynamics and MHD. **John Coffman** is a computer specialist pursuing his E.E. Stu, Fred, and John each served as teaching assistants during the past academic year. . . . At the Awards Convocation this past spring, **Lawrence L. Bucciarelli,** Ph.D., was awarded the Everett Moore Baker Award for Outstanding Undergraduate Teaching.

Jack Elder (II) is still at M.I.T. working for his Ph.D. in mechanical engineering. He and his wife Nan were "pleasantly surprised" to find that Nan graduated *cum laude* from Boston University. . . . **David Mundel** (VIII and XVII) is working on his degree in political science, planning to finish next June. He is presently looking at national educational policy, while serving as a consultant to RAND and Brookings. Dave and his wife Elisabeth stopped

by our home in Oxford this June while on a short English holiday. Three weeks later we met again—this time 7,000 miles away in Santa Monica, Calif. . . . **Bo Pasternack** is a part of a Stanford team that designed a lunar pogo stick that will allow future astronauts to hop across the lunar surface in 50-foot leaps.

Stu Vidockler is treasurer and a director of the Intermidia Systems Corp., Cambridge, while **Peter Wessel** is back in Norway with the Radionette Co. . . . A 1968 graduate of the Harvard Business School, **Mike Kinkead** now works for Decision Technology, Inc., Cambridge.

Richard Wolf is marketing engineer with Lockheed Aircraft in Burbank, Calif. McDonnell-Douglas, Huntington Beach, Calif., claims **Carson Eoyang, Jurgen Hahn, Rich Lucy,** and **Ralph Schmitt.** Others in California include **Steve Levin** with G.E. at Sunnyvale; **Paul Branstad** with Litton Industries of Los Angeles; **Elliot Hinely** of the Stanford Research Institute in Menlo Park; and **Martin Melnick** of TRW Systems in Los Angeles.

Hank Perritt is with Lockheed-Georgia; **Robert Fila** is marketing analyst with Humble Oil, Houston; **William Cain,** Assistant Professor of Finance, is at Georgia State College; and **Wayne Baxter** is also in Houston working for Bonner & Moore Consultants. . . . Boeing of Seattle has **James Gordon** and **Dennis Jedlinsky.** Working for M.I.T. are **David Root** (back from a 24-month assignment in Bangkok); **Robert Wells,** in the Department of Civil Engineering; and **Harry Moser,** in the Industrial Liaison Office. Working in the Boston area are **Peter Addis,** a scientific programmer with Raytheon; and **Michael Feldstein,** a development engineer for Honeywell Electronic Data Processing Division. . . . In the New York-Philadelphia-Pennsylvania area we have: **Aaron Snyder,** working on satellite communications systems for Philco-Ford; **William Schnicke,** working on nuclear test detection of General Atronics Corp.; **Michael Gordon,** working for the Celanese Corp. following two years in the Army Signal Corps doing research in liquid laser systems; **W. H. Speaker,** following completion of an M.B.A. at Wharton, joining Mobil Oil Co.; **Mark Yogman,** working for the Esso Math and Systems Division of Standard Oil (N.J.). . . . **Richard Leslie** is now associated with the Halogens Research Lab of Dow Chemical Co. . . . Involved with the Apollo program is **Don Schwanz,** a program manager for Univac's Federal Systems Division.

David Vanderscoff has been promoted to the position of an Actuarial Assistant with New York Life following completion of parts 5 and 6 of the Society of Actuaries' Exams. . . . **Tom Gomersal** is a 1st Lieutenant at Warren AFB, Colorado, and a part-time graduate student in computer sciences at Colorado State. . . .**William Moss** is an instructor at the Navy Nuclear Power School, Bainbridge, Md. . . . **Harold Helfand** is in the U.S. Public Health Service attached to the National Cancer Institute. . . . As for me, I finally got my S.B. and S.M. in Course II, January, 1968. I married Renée Marie Leet of Culver City, Calif., on March 2, and we proceeded to Tullahoma, Tenn., to set up our first home. (Don't laugh! That's the biggest town for 40 miles, until one gets to Murphreesboro!) There I was a staff engineer with ARO, Inc., operators of the free world's largest wind tunnel complex. My job was to travel around the country, culling ideas, and projecting ARO's test facility needs into the future. In September we heard the school bell ring so we packed up all our belongings (mostly books) and moved to Oxford, England, where I'm trying to eke out a D.Phil. (That's English for Ph.D.) in biomedical engineering. On March 8 Anne Cathleen was born here, giving her the distinction of dual citizenship. Besides the Mundels, we entertained Bill and Molly Roeseler, '65, in June, and we see a lot of Dick Tsien, '65, who is also studying at Oxford. After a couple months in California this summer consulting for RAND, we are back at Oxford again and hope to stay for a few more years. [Although he failed to report it, Terry's athletic feats received considerable attention in the *Oxford Mail.* It seems that he came through with a big assist and some excellent defensive play in Oxford University's second straight lacrosse victory over its chief rival, Cambridge. He is captain of the team this year.—Ed.] That's it for this month. Hope to hear from you all soon. Remember to put airmail postage on your letters if you send them to me here. If you are in England, stop by for a glass or two of sherry! We're only one hour from London by train. Until next month, cheers!—**Terry J. Vander Werff,** Secretary, 24, Horwood Close, Oxford, England OX3-7RF

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I just received my monthly envelope of clippings, cards and miscellaneous gossip from the office of *Technology Review.* The envelope is well-stuffed (postage, $4) as it covers most of the summer months. Since I also received many personal letters, I am planning to save some of the material until next month. I give a big "thanks" to those of you who have written. As for you others . . . you. . . .

"Oscillating Waste-basket" wins

A computer-designed graphic called "Oscillating Waste-basket" recently won a $2,000 scholarship for the University of Toronto. **George Olshevsky,** who wrote the program using an IBM 7094 II with a Calcomp 665 plotter, received $200 as third prize in a nationwide U.S. competition. "Oscillating Waste-basket" is a foot-wide and two-foot-high design vaguely reminiscent of a wicker basket wide at the top, middle and bottom with two narrow wastes. In detail, however, its many criss-crossed spiral lines remind one of the finest filigree work by a Baghdad silversmith. Since September, 1967, George has been working for his masters in computer science at the University of Toronto.

Michael Zuteck is working for TRW Systems Group in Houston in support of N.A.S.A. Their present study concerns the effects of radio reflections from the moon on S-band communication and tracking antenna operations. Mike also owns and sails a Tornado class racing catamaran. . . . **Dave Dilling** and his wife Kathy are living in Palo Alto, Calif., where Dave works in the Scientific Development Department of Bechtel Corporation, specializing in the economics of nuclear power. Until last March he had been working with Douglas United Nuclear in Richland, Washington. . . . **Susumu Mitarai** is with Scott Paper, after graduating from the M.B.A. program at Wharton.

Colleen and **Bill Turner** are now living in Indianapolis where Bill is working as an associate research chemist at Eli Lilly and Co. He is also studying for his masters at Purdue regional. The Turners have three children: Jordon (3), Jennifer (2), and Jill (almost one). . . . **Stuart Ross** is working at the Salk Institute in San Diego on programs analyzing the social implications of biological research. . . . **Dave Sanders** received his M.B.A. from Harvard last January and is now a production engineer for Hewlett-Packard in Cupertino, Calif. . . . **Barry Watkins** is working for the Budget Director in Rochester, N.Y.

Ted Williams writes that Berkeley "is always lively, to say the least. In one year, we've had: a student strike with tear-gas, bottles, rocks, and clubs; last summer's 'street people' confrontation with tear-gas, bottles, rocks and clubs; and a People's Park conflict with tear-gas, bottles, rocks and clubs. The last even also included buck-shot and loss of life." Ted's wife Kathy graduated from Berkeley in June with a B.A. in social welfare. Ted is still at San Francisco Bay Naval Shipyard (site of the now infamous *Guitarro* 63-hour immersion test) on a staff designing the second generation ballistic missile submarines. . . . **Mel Snyder** has transferred from Cincinnati Medical School to Tufts Medical School.

Lloyd Lewis is busy working on his Ph.D. in Ocean Engineering at U.R.I. . . . **Richard Weiner,** having received his M.S. in Systems Engineering from the University of Pennsylvania, entered Duke University Medical School this fall. He is married and the proud father of a baby boy.

Robert Steele, a graduate student in chemistry at Berkeley, is working for Professor C. B. Moore on a chemical lazer. He has a II-A draft classification; naturally he's keeping his fingers crossed. . . . **John Robinson** reports a new position as a marketing specialist in the precision controls department of Texas Instruments. He's also studying part-time for his M.B.A. degree at Boston University. . . . **Dave Avrin** and wife Marcy are residing in New Haven, where he is continuing his research at Yale.

Having finished his course requirements at the University of Michigan, **Gerry Bunce** is working on his experi-

mental thesis in high energy physics. . . . **Gerald Lisowski** has been working towards a Ph.D. in organic chemistry at the University of Wisconsin where he has an N.I.H. fellowship. At last notice he was planning to ride his cycle from Madison to New York City, via a two-week vacation in Canada. . . . Last summer **Lawrence Burgess** wrote that he expected to receive an engineer's degree in September and that he was planning to work in California, Massachusetts, or for Uncle Sam. . . . **Robert Gerstle** has finished his second year of medical school at N.Y.U.'s School of Medicine. He married the former Nancy Goodman in July.

"Discovering that engineering is not my 'bag' after all; I am now a farmer and quite happy." writes **Peter Dinsdale.** . . . **Ken Lerner** is making films. . . . **Guillermo Arnaud,** at last notice, was trying to finish his masters thesis at R.P.I. and stay out of the Army. He expected to graduate in the summer and then locate a job. . . . **John Gowdy** received his M.S. in electrical engineering from the University of Missouri in June, 1968. He says that the Air Force wouldn't take him because of his coke-bottle glasses, so he's now working on a Ph.D. . . . **Avram Markowitz** wrote the following last summer "Thought I'd bring you up to date on my doings. After receiving an M.S. in M.E., June, 1968, I joined Raytheon in Bedford, Mass. In January, 1969, I passed the qualifying exams in M.E. and will be returning to M.I.T. in September to complete my thesis and course requirements for the Ph.D. In August I'll be presenting a paper, based on my M.S. thesis, at the 11th National Heat Transfer Conference in Minneapolis. I've been married for three years, and my wife Annette is at present an editorial assistant in the Man-Space Vehicle Laboratory of the aero-astro department at Tech." . . . **Ed Riley** is an engineer with Advanced Engine Systems Group, General Electric, Lynn, Mass.

George Reichenbacher has joined North Atlantic Industries of Plainview, Long Island, N.Y., as Senior Project Engineer. . . . **Alan Sloan** has a new position as vice president and general manager of WCBS-TV in New York. . . . **Spence Sherman** received his masters in psychology from Stanford and is currently flashed out." . . . **Donald Poestreicher** and his wife Cynthia (daughter of Jesse Van Horne, '34 M.E. II) are expecting their first child in December. At the same time, Don will be finishing his first semester in the Ph.D. program in computer science at the University of Utah. . . . **Jeff Wiesen** is back at Yale Law where he has a year and a half to go before entering the "real" world as a lawyer. Jeff and his wife Elaine were living in Colorado while Jeff was stationed at Lowry AFB attending missile electronics school. Fortunately he managed to get into the Connecticut Air National Guard and to go off active duty in time to return to school in September. Jeff writes that he has spoken to **George Piccagli,** who is still at Chicago in sociology. . . . **Bill Kiecan** is employed by Communications Co., Inc., of Coral Gables, Fla. As Development Engineer, Bill designs and tests new hand-mobile transceivers for aircraft and commercial use. . . . Last May **Wayne Moody** was appointed Planning Director of Tiburon, Calif., a city with a population of about 6,100 located just north of San Francisco. (It's the only city left with direct ferry connection to San Francisco.) . . . **Amitavi Gangulee,** Ph.D., is presently research staff member at the I.B.M. Watson Research Center, Yorktown Heights, N.Y.

Kevin Kinsella, upon having received his M.A. in international relations from Johns Hopkins, is teaching in Beirut, Lebanon, for the present school year. Thanks to a Rotary International Fellowship he will be studying in Scandinavia during 1970-1971.

Fred Keene writes that he is "still at Berkeley plugging away in the doctoral program in math. There are so many ex-tools around here that it's almost like I never left home—woops, Tech!"

Last June **Victor Bermudez** received a Master of Arts in chemistry from Princeton. . . . **Richard Rettig,** Ph.D., joined the Cornell faculty in February, 1969, as Assistant Professor of Public Administration of the Graduate School of Business and Public Administration. He serves as Secretary to Cornell University Program in Science,Technology and Society.

John Ritsko received his M.A. in physics from Princeton in June. . . . Last February **Jimmy Sutton** was married in Fall River, Mass., to the former Nancy Corner, a Simmons College graduate. He's presently working as a scientist for Lockheed Missiles and Space at the Palo Alto Research Lab. . . . **Robert Landley** married the former Miss Carol Hiemenz in June. They spent their honeymoon in the Bahamas. . . . Major **Mark Magnussen** presently monitors construction of 1st Logistical Command facilities in Vietnam. He will be there until spring.

Paul Martin, who has been working with an agricultural cooperative in Bolivia, was among the leaders of a protest by Peace Corps workers over attempt by the U.S. ambassador to have a corps worker pulled out of that country. . . . **Dick Chandler** received his M.B.A. from the University of Michigan last December. In January he married the former Eileen Dinsmark of Allen Park, Mich. He is presently living in Evanston while working on the audit staff of Pert, Monunide, Mitchell & Co., of Chicago. . . . Last June was an eventful month for **Ken Sidman**—he married the former Margie Schnaper, received his masters degree in chemical engineering from M.I.T., and began working for Dynatech Corporation in Cambridge. . . . I received word that the following classmates attended Alumni Day, June 16: Mr. and Mrs. **Dave Benson,** Mr. and Mrs. **Paul Konnersman,** and **Henry Link.** . . . Miss **Margaret Jones** worked for Colgate Palmolive in New York City during the summer, having completed her first year at the Harvard Business School. . . . **Edward Pressman** and his wife Joan took an architectural tour of Europe during the last four months of 1968. . . . **Robert Lavoie** was released from active duty after two years in the Army Corps of Engineers. As a post engineer with the rank of captain at the Charleston Army Depot, S.C., he received the Army Commendation Medal for meritorious service. . . . **Charles Spann** was working on a masters degree in air pollution control engineering at West Virginia University when he was drafted in January. He is now stationed at West Point—as an M.P.! And with that final bit of great news I will leave you.—**Jim Swanson,** Secretary, Services Provinciaux, Beni-Mellal, Morocco

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Gail and I have now returned to Cambridge and the old grind after the long summer. In June we went to the I.E.E.E. Communications Conference at the University of Colorado in Boulder. This was followed by side trips to San Francisco and Phoenix. We then settled down to our old jobs from the previous summer, Gail was at Ft. Monmouth studying radiation effects and I was back at Bell Labs in Holmdel, N.J., studying digital switching systems. Indeed, so little had changed we both had the same desks and telephone numbers. However, we did have a different apartment in Asbury Park. From July 20 to August 16, I sampled military life first hand at R.O.T.C. summer camp. I shall describe this shortly but first we must have the . . .

Nuptial notes

As is the tradition in this column, coeds get top billings so we happily announce that **Fredda Hoffman** was married to Francis X. Cole last June. He is a graduate student in Course VII and Fredda is now working for Raytheon in Burlington, Mass. . . . **John Sole** was married to Louise Davis in December while he was working there on the oil platforms of oil slick fame. In April he was transferred to Northern Peru as an assistant project engineer on the construction of offshore platforms and submarine platforms in Talara. He has been accepted at Stanford for a masters but the "draft situation may spoil that." . . . **Joel Wolf** was wed to the former Catherine Gody, Jackson '69, in December. . . . **Jack Rector** has married Bonnie Bryce from Salem, N.H. . . . **Mark Johnson** wed Kay Fitzgerald on June 14. He is working at G.E., West Lynn, as a program analyst system engineer. . . . A busy summer full of weddings was reported by **Scott Richard** who married Susan Lee Diamond in New Orleans on June 15. . . . **Mike Rodburg** was next, marrying Ros Snyder in Cincinnati on June 22. . . . A week later **Steve Silverstein** married Sue Blonde in Schenectady on June 28. . . . Finally, **Corky Polay** married Jane Welch in Boston on September 7.

On June 21, **James Getschman** was wed to Joan Gray, a graduate of William Woods College, in Greenbelt, Md. He is

working for Communications and Systems, Inc., in Falls Church, Va. . . . **Dennis Artman** married Juanita Louise Jarvis of Alburg, Vt., on June 28. Dennis is doing graduate work at the University of Vermont in Burlington. . . . **Paul Richter** was married in August to Geraldine Kelleher in the Wellesley College Chapel. The ushers were **Ken Hawes,** John Kulp, '71, and Stephen Nadeau, '69. Geraldine is a Wellesley graduate and will attend Georgetown School of Medicine. Paul will continue at George Washington University studying law.

Roy Shapiro, a high school classmate of mine, became engaged to Deborah Davis of Brookline, a Senior at the University of Massachusetts in Amherst. They are planning a June wedding. . . . **Bob Young** is engaged to Kathleen Brown, a 1968 graduate of Finch College in New York, and is planning a March wedding.

Selective Service Stories

As I mentioned above, I spent four weeks this summer at R.O.T.C. Field Training at Pease AFB, N.H. The details are not worthy of mention, but let it suffice to say that we got up at 5:20 a.m. to do the 5BX test daily and went to bed at 9:15 p.m. I now consider myself an expert at polishing boots and waxing floors. Indeed my roommates and I had our floor polished so much that the officer who inspected it almost slipped one day!
I hear that OTS and basic training for enlisted men are longer and worse in all respects. My experience at Pease was shared with three other M.I.T. men: **Bill Carlson,** John Pepin G, and Greg Lewis, '70. As I had already finished the on-campus part of R.O.T.C. I was commissioned a 2nd lieutenant at the end of camp. I have an educational delay from the Air Force and expect that it will be continued until I finish the doctoral program.

Stan Gottschalk and **Dave Ellis** spent six weeks this summer in scenic Ft. Benning, Ga., at R.O.T.C. summer camp for the 2-year Army program. Stan is continuing in graduate school at the Institute while Dave is returning to Harvard Law. . . . **Carl Martland** reports that he was drafted on January 31, is now stationed at Ft. Devens, and was just married to Nancy Fitzgerald, Wellesley '70. He points out that between the two events he is broke. . . . **Peter Rode,** who I previously reported as being drafted, is stationed at Ft. Eustis, Va. . . . From **Ken Wang** I received the following laconic note, "Drafted July 16." . . . **Don Frye** has resumed study at Brown after four months of National Guard training at Ft. Knox, Ky. He was lucky enough to be sent to Cook School so at least he learned something useful. . . . **Bob Kispert,** who received a commission from N.R.O.T.C., is stationed in Jacksonville, Fla., with his wife Jean. He works for the Supervisor of Shipbuilding, Conversion, and Repairs, U.S. Navy, as a Design Officer. He says that he's in charge of a 10-man design group and really enjoys the assignment adding that "Florida's a great place to live."

It is possible to fulfill one's military obligation by joining the Public Health Service. **Bob Phair** has taken this option and writes: "The ogre of the draft has driven me from graduate school in biomedical engineering at Northwestern University. My wife, Judy (Simmons '68), and I are now living in Cincinnati where I am beating the draft as a commissioned officer in the U.S. Public Health Service." He reports that **John Corwin** is also in the P.H.S. and lives with his wife Laurie in the same apartment complex as they do. . . . **Michel Froidevaux** is in the French Air Force until February, 1970. He is working in a computer laboratory on statistical estimation in Paris. He reports that "military wages are rather poor in our country," something not unique to France.

William Fitzgerald, Course XII, is serving with the Corps of Engineers in Vietnam working on an irrigation project and will return in May. . . . Lieutenant **Robert Degan,** Course I, is in charge of a unit of Seabees in Vietnam for the purpose of reconstruction. He expects to return in December. . . . Captain **Jack Krafchick,** Course II, was promoted to his current rank in August and was assigned to the 18th Engineer Brigade in Vietnam. He was previously assigned to the Mobility Systems Laboratory, U.S. Army Tank Automotive Command, Warren, Mich. Jack reports that his daughter Jennifer Lynn was born on January 24. . . . Captain **William Kakel** is a company commander with the 8th Engineer Battalion in Vietnam. His next assignment will be with the Office of the Chief of Engineers in Washington, D.C.

John Brasel writes the following about his view of the draft: Convinced that war is harmful to human beings, and cognizant of the fact that induction is voluntary, I have decided not to enter the Armed Forces. Not wishing to make a federal case out of it, I am also seeking conscientious objector classification from my draft board." . . . **Paul Langacher** adds the following final note, "Resist the draft."

Margaret Eikrem has completed her first year of medical school at Washington University in St. Louis. She spent the summer working as a physicist at J.P.L. in Pasadena. . . . **Barry Blumenfeld** is a graduate student in physics at Columbia and a Technical Collaborator in the physics department at Brookhaven. . . . **Leonard Schaper** has been teaching at Newark College of Engineering and reports marrying during the summer. . . . **Stephen Cohen** is at the Georgetown University School of Medicine but spent the summer working for the Nutrition and Food Science Department at M.I.T. . . . **Kannson Liu** writes that he is still struggling for a Ph.D. at Washington State University. . . . **John Lisle** is an instructor in the chemistry department at Carnegie Mellon University.

Ray Paret writes that he has just returned from a short business trip to England and that record production is going well. He says that he is always looking for new talent, so all you rock singers and bands write now to Amphion, 240 Huntington Ave., Boston 02115, for your golden opportunity to make the big time. . . . **Peter Bradish** reports that he and his wife Gayle took a 10-day vacation to Bimini in the Bahamas during May and sailed over on a 25-foot sloop. He points out that somebody could make a mint selling "Think Surf" signs in Florida. . . . **Leonard Mausner** had been teaching mathematics as J.H.S. 120 in the Bronx but now has returned to graduate school at Princeton. . . . **Robert Benveniste** is working for Bell Helicopter in Ft. Worth. He finds the work exciting but misses Boston. . . . **Ron Rosen** finished a 5-year program and received an S.B. in Course VIII and an S.M. in Course II. He is now teaching physics, physical sciences, and some mathematics at the Sterling School, a boarding school in Vermont.—**Gail** and **Mike Marcus,** Secretaries, Eastgate Apt. 16A, 60 Wadsworth St., Cambridge, Mass. 02138

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Perhaps the most interesting reading in *Technology Review* is this section, the Class Review. It enables us to share experiences with our classmates and the Institute as we advance in industry, science, engineering, and community service. Moreover, it provides a mechanism for transmitting information to those with whom we have lost contact regarding such events as marriages, births, future graduations, promotions, publications, community activities, military service, and changes in residence. Since I cannot possibly know what everyone is doing, please drop me a note, and I'll place it in the class column as soon as possible.

Paul Smith has joined the General Electric Research and Development Center in Schenectady, N.Y., as an electronics engineer in the mechanical engineering laboratory. . . . **Bob Schaffer** and **Dean Vanderbilt** attended Alumni Day (Homecoming) on June 16. . . . **Eben Walker** received his Army Reserve commission as a 2nd lieutenant in field artillery on June 12; he also received a delay in reporting for active duty to commence graduate studies at the Sloan School. . . . **Elroy Eckhordt** is currently at Tulane University as a doctoral candidate. . . . **Wen F. Cheng** will be teaching as an associate professor at Tatung Institute of Technology, Tapei, Taiwan, Republic of China. . . . **Bernard Lietaer** has joined the consulting firm of Cresap, McCormick and Paget. . . . **Elizabeth Louise Grundlehner** exchanged marriage vows with another M.I.T. graduate William Joseph Riordan, '66, on June 10; her husband is associated with the MITRE Corp., Bedford, Mass., as a mathematician. . . . Your Class Secretary, who doubles as Treasurer, will be entering Harvard Law School this fall. . . . Once again, I am waiting to hear from you.—**Dick Moen,** Secretary, c/o *Technology Review,* Room E19-430, M.I.T., Cambridge, Mass. 02139

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THE ORIENT

30 DAYS $1649

1970 will mark the sixth consecutive year of operation for this fine tour, which offers the true highlights of the Orient at a sensible and realistic pace. As a special attraction, spring and summer departures will include a visit to the **"EXPO 70" World's Fair** in Osaka. Twelve days will be spent in **JAPAN**, divided between **TOKYO**, the **FUJI-HAKONE NATIONAL PARK**, and the ancient "classical" city of **KYOTO**, with excursions to **NARA** and **NIKKO**. A further highlight will be a comprehensive visit to the famous ruins of **ANGKOR WAT** in Cambodia, together with visits of 4 to 5 days in **BANGKOK** and **HONG KONG** and a shorter visit to **SINGAPORE**. Optional pre and post tour stops may be made in **HONOLULU** and the **WEST COAST** at no additional air fare. A complete program of sightseeing will include all major points of interest. Features range from a tour of the canals and floating markets of Bangkok and an authentic Javanese "Rijsttafel" dinner in Singapore to a launch tour of Hong Kong Harbor at sunset and a trip on the ultra-modern 125 mph express trains of Japan. Most tour dates include outstanding seasonal attractions in Japan, such as the spring cherry blossoms and beautiful autumn leaves and some of the greatest annual festivals in the Far East. Total cost is **$1649** from **California, $1819** from **Chicago, $1887** from **New York**. Special rates from other cities. Departures in March, April, June, July, September and October, 1970.

INDIA

Including NEPAL and PERSIA

28 DAYS $1699

An unusual opportunity to see the diverse and fascinating subcontinent of India, together with the once-forbidden kingdom of Nepal and the rarely-seen splendors of ancient Persia. Here is India from the mighty Himalayas to the palm-fringed Bay of Bengal: the great seaport of **BOMBAY**; the magnificent cave temples of **AJANTA** and **ELLORA**, whose thousand year old frescoes are among the outstanding achievements of Indian art; the unique "lake city" of **UDAIPUR**; the walled "pink city" of **JAIPUR** with an elephant ride at Amber Fort; **AGRA**, with the Taj Mahal and other celebrated monuments of the Moghul period such as the Agra Fort and the fabulous deserted city of Fatehpur Sikri; the holy city of **BANARAS** on the sacred river Ganges; the industrial city of **CALCUTTA**; a thrilling flight into the Himalayas to **KATHMANDU**, capital of **NEPAL**, where ancient palaces and temples abound in a land still relatively untouched by modern civilization; the great capital of **NEW DELHI**; and the fabled beauty of the **VALE OF KASHMIR** amid the snow-clad Himalayas. **PERSIA** (Iran) includes the great 5th century B.C. capital of Darius and Xerxes at **PERSEPOLIS**; the fabled Persian Renaissance city of **ISFAHAN** with its 16th century palaces, gardens, bazaar, and famous tiled mosques; and **TEHERAN**. Outstanding accommodations include hotels that once were palaces of Maharajas and luxurious houseboats on Dal Lake in Kashmir. Total cost is **$1699** from **New York**. Departures in February, August and October, 1970.

AEGEAN ADVENTURE

21 DAYS $1299

This original itinerary explores in depth the magnificent scenic, cultural and historic attractions of Greece, the Aegean, and Asia Minor—not only the major cities but also the less accessible sites of ancient cities which have figured so prominently in the history of western civilization, complemented by a luxurious cruise to the beautiful islands of the Aegean Sea. Rarely has such an exciting collection of names and places been assembled in a single itinerary—the classical city of **ATHENS**; the Byzantine and Ottoman splendor of **ISTANBUL**; the citadel of Agamemnon at **MYCENAE**; the ruins of ancient **TROY**, the sanctuary and stadium at **OLYMPIA** where the Olympic Games were first begun, the beginnings of western civilization at **CRETE**, the ruins of **SARDIS** in Lydia where the royal mint of the wealthy Croesus has recently been unearthed; centers of the Ionian League such as **MILETUS** and **PRIENE**; the magnificent marble city of **EPHESUS**; crusader castles at **RHODES** and other sites; beautiful Aegean islands such as **DELOS, MYKONOS, PATMOS** and **HYDRA**, as well as **CORINTH, EPIDAUROS, DELPHI, PERGAMUM, DIDYMA, IZMIR** (Smyrna), the **BOSPORUS** and the **DARDENELLES**. Total cost is **$1299** from **New York**. Departure in April, May, July, August, and September 1970.

EAST AFRICA

21 DAYS $1649

A luxury "safari" to the great national parks and game reserves of Uganda, Kenya and Tanzania. These offer a unique combination of magnificent wildlife and breathtaking natural scenery: great herds of elephants in **QUEEN ELIZABETH PARK**, in the shadow of the fabled "Mountains of the Moon"; a launch trip on the White Nile through hippo and crocodile to the base of the thundering **MURCHISON FALLS**; multitudes of lion and other plains game in the famous **SERENGETI PLAINS** and the **MASAI-MARA RESERVE**; the spectacular concentration of animal life in the **NGORONGORO CRATER**; tree-climbing lions around the shores of **LAKE MANYARA**; and the **AMBOSELI RESERVE**, where all types of big game can be photographed against the towering backdrop of snow-clad Mt. Kilimanjaro. Air travel is used where possible, enabling longer stays within the parks. Also seen are the fascinating capital cities of **KAMPALA, NAIROBI** and **DAR ES SALAAM**, the exotic "spice island" of **ZANZIBAR**, and the historic **MOMBASA**, a beach resort on the Indian Ocean, with its colorful Arab quarter and great 16th century Portuguese fort. Tour dates have been chosen for dry seasons, when game viewing is at its best. The altitude of most areas provides an unusually stimulating climate, with bright days and crisp evenings (frequently around a campfire). Accommodations range from luxury hotels in modern cities to surprisingly comfortable lodges in the national parks (some equipped even with swimming pools). Total cost from **New York** is **$1649**. Departures in July and September, 1970.

Rates include Jet Air, Deluxe Hotels (where available), Meals, Sightseeing, Transfers, Tips and Taxes. Individual brochures on each tour are being prepared.

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